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NUCLEAR PROLIFERATION: FUTURE U.S. FOREIGN POLICY IMPLICATIONS

HEARINGS

BEFORE THE

SUBCOMMITTEE ON INTERNATIONAL SECURITY AND SCIENTIFIC AFFAIRS

OF THE

COMMITTEE ON INTERNATIONAL RELATIONS HOUSE OF REPRESENTATIVES

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INTRODUCTION

Progress is sometimes a double-edged sword. Such is the dilemma of nuclear energy. Controlled, it can give with abundance; unleashed or misdirected, it can take with vengeance. For mankind the ultimate challenge thus becomes one of separating the potential blessing from the threatening scourge.

That, in brief, is the problem explored in the hearings contained in this volume. In fulfillment of its mandated responsibilities, the Subcommittee on International Security and Scientific Affairs attempted to thoroughly review the broad and complex question of nuclear proliferation in terms of its future U.S. foreign policy implications.

In its efforts the subcommittee was fortunate to have the cooperation of a distinguished group of witnesses, including Members of Congress, private experts, representatives of interested professional organizations, and various executive branch spokesmen. Their testimony, together with an appendix of related documents, provides a significant body of information and informed opinion.

These published hearings are presented now to the Congress and the public with the hope that they will contribute meaningfully to the long overdue and urgent dialog of what can be done to prevent disaster. Recognizing that there is still precious little time to cope with the problem, we must now seek the will and the way. To that end we trust these hearings will provide deepened understanding of the problem and a renewed commitment to solve it.

Having completed this comprehensive survey the subcommittee intends in the near future to report legislation to the full International Relations Committee.

Clement J. Zablocki,
Chairman, Subcommittee on International
Security and Scientific Affairs.

NUCLEAR PROLIFERATION: FUTURE U.S. FOREIGN POLICY IMPLICATIONS

TUESDAY, OCTOBER 21, 1975

House of Representatives,
Committee on International Relations,
Subcommittee on International
Security and Scientific Affairs,
Washington, D.C.

The subcommittee met at 11:20 a.m., in room 2255, Rayburn House Office Building, Hon. Clement J. Zablocki (chairman of the subcommittee) presiding.

Mr. Zablocki. The subcommittee will come to order. The Subcommittee on International Security and Scientific Affairs opens this morning its hearings on one of the most crucial problems facing this Nation and all of mankind—the unleashed worldwide spread of nuclear power.

That issue of nuclear proliferation is the one with which we will try to deal. Its presents a dilemma of vast proportions and complex implications. On the one hand, it involves a world in need of new and dependable sources of energy. However, what that search brings with it is the ever-growing threat of nuclear war born of an inadequately controlled abundance of nuclear technology.

ON THE FAST ROAD TO POSSIBLE DISASTER

Evidence pointing to the seriousness of the danger abounds. For example: Nuclear materials, from which nuclear explosives could ultimately be made, now exist in approximately 30 countries. It is estimated that by 1985 nearly 50 countries will have at least one nuclear powerplant that can produce enough plutonium each year for at least several dozen nuclear explosives. By the year 2000, the annual rate of plutonium production worldwide will be nearly 1 million kilograms—enough to make 100,000 nuclear explosive devices.

Regrettably, attempts to deal with this enlarging threat have met with only limited success. Today, for instance, only 97 states are parties to the Nuclear Non-Proliferation Treaty (NPT). In addition, the nuclear arms race between the superpowers continues and the spread of nuclear technology runs on unabated.

We are, in short, on the fast road to nuclear proliferation and possible disaster. Yet, there is still time to act—albeit precious little time.

The question to which we seek an answer here is simply this: Do we let the spread of nuclear power go on pellmell, or with statesmanlike responsibility, do we attempt to seek reasonable controls? This may be our last chance to answer that question rationally.

The legislative base of these hearings, House Concurrent Resolution 371, is an attempt to answer that question. It represents an effort to move the Congress and the executive branch toward a meaningful and workable solution. Here to assist us in that effort are three Members of Congress who have a deep interest in the subject. Our kickoff witness is the Honorable Alan Cranston, Senator from the State of California and author of Senate Concurrent Resolution 69, legislation similar to House Concurrent Resolution 371.

[Copy of House Concurrent Resolution 371 follows:]

[H. Con. Res. 371, 94th Cong., 1st sess.]

CONCURRENT RESOLUTION

Whereas the operation of the Treaty on the Non-Proliferation of Nuclear Weapons was reviewed in May 1975, by a special conference which included parties to such treaty;

Whereas such conference confirmed the fact that states with nuclear weapons capability have made only limited progress in pursuing "negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and a treaty on general and complete disarmament", as called for by such treaty;

Whereas a significant number of non-nuclear weapons states have not acceded to such treaty; and

Whereas it is important that further efforts be undertaken on an urgent basis to limit the dangers involved in peaceful and military nuclear developments and that the position of the United States Congress be understood with respect to its willingness to give full effect to the terms of the Treaty on the Non-Proliferation of Nuclear Weapons and to take further steps to limit nuclear dangers: Now, therefore, be it

Resolved by the House of Representatives (the Senate concurring), That the President of the United States is respectfully requested to inform the appropriate foreign countries of the following declarations by the Congress of the United States with respect to arms control and disarmament negotiations and the proliferation of nuclear weapons materials:

(1) The Congress of the United States, noting the positive steps embodied in the Vladivostok Accord of November 24, 1974, urges their prompt embodiment in a treaty. The Congress further urges, after the conclusion of such a treaty, immediate negotiations on a verifiable mutual 20 per centum reduction in the number of strategic nuclear delivery vehicles and the number of strategic missile launchers equipped with multiple independently targetable reentry vehicles.

(2) The Congress of the United States urges a comprehensive agreement ending underground nuclear explosions under adequate verification if all other nuclear weapons states will enter into such an agreement.

(3) The Congress of the United States, in order to reinforce international actions to prevent the proliferation of nuclear weapons and other nuclear explosive devices, urges a halt on further transfers of nuclear fuel, technology, and equipment to any country which has not accepted International Atomic Energy Agency safeguards on all its nuclear programs or which by January 1976, has not become a party to the Treaty on the Non-Proliferation of Nuclear Weapons if all other major nuclear suppliers agree to a similar halt on such transfers.

(4) The Congress of the United States urges an agreement providing that, with respect to any plutonium for peaceful uses resulting from any transfer between countries of nuclear fuel, technology, or equipment, all processing of such plutonium (from its extraction from spent reactor fuel elements through its processing, storage, and its final fabrication into new fuel elements and their installation into nuclear reactors) will be performed in regional facilities which are heavily protected and guarded under the strictest possible multinational safeguards.

Senator Cranston, we are indeed very honored and privileged that you have taken time to testify before our subcommittee. Senator, you may proceed, please.

STATEMENT OF HON. ALAN CRANSTON, A U.S. SENATOR FROM THE STATE OF CALIFORNIA

Senator CRANSTON. Thank you very, very much. I want to say first that I agree with everything you just said in your opening statement including the first sentence in which you said this is one of the most important problems facing our Nation and mankind.

I would like to go beyond that to say it is the most important question. If we don't resolve this one and permit catastrophy to occur, we may not even be able think about dealing with other problems.

I have profound admiration for the leadership you and Congressman Findley have been providing in this field. I have had the opportunity of working very closely with him on many matters of mutual interest and I am delighted that the two of you are doing what you are doing.

I appreciate the opportunity to appear before you to testify in support of the purposes and goals incorporated into the resolution introduced by Representatives Zablocki, Fountain, and Bingham in the House and a similar resolution introduced in the Senate by myself, Senator Brock, and Senator Mathias. I might add that six of the nine members of the Foreign Relations Arms Control Subcommittee joined us as cosponsors at the time the Senate resolution was introduced, indicating the very great support that we have for it.

The other three members of that subcommittee have expressed real interest in the resolution and I especially welcome the encouragement we have received from the chairman of that subcommittee, Senator Symington.

SUBCOMMITTEE PERFORMANCE PRAISED

Before addressing the resolutions that are the subject of this hearing, Mr. Chairman, let me express my admiration for the work of this subcommittee of the International Relations Committee. I know of no committee on Capitol Hill that has investigated the problems of national and international security with the imagination and breadth of vision displayed by this subcommittee.

For years, you have been throwing light on every important topic related to controlling nuclear weapons, from the issues in the SALT talks to the decisionmaking processes of our own Government pertaining to command and control over nuclear weapons—not to mention the hearings and studies you have conducted on every other important aspect of national security policy.

Mr. Chairman, these resolutions recognize the fact that nuclear power is on the loose in the world and that this is the most urgent problem facing our Nation and mankind. It is a problem which demands the serious day-to-day attention of both the Congress and the executive agencies, if our civilization is to survive.

There are many ways to illustrate the danger of our dilemma. Let me cite one recent estimate by Prof. Lincoln Bloomfield writing in "Foreign Affairs." He estimates that there will soon by 7,000 to 12,000 annual shipments of spent fuel rods between reactors and reprocessing plants. By the early 1980's, this will mean that the present nonweapons countries will have available to them annually enough plutonium 239 to make 50 atomic bombs a week—if they choose to.

VALUE OF THE RESOLUTIONS

What can these concurrent resolutions accomplish? They have meaning in several respects:

One: If passed by Congress, such a resolution would be seen as a major congressional initiative for peace, addressing several major aspects of the nuclear control problem. It is a means by which Congress, in an act of statesmanship, can respond to the challenge of a very dangerous nuclear world by advising the President, and the nations of the world, just how far we are willing to go in bringing nuclear power under control.

The resolutions address the SALT negotiations, arms reductions, nuclear tests, and the proliferation problem. In omnibus fashion, most aspects of the nuclear threat are dealt with, in contrast to numerous resolutions introduced in Congress which deal with individual aspects of the problem.

Two: A resolution such as we are proposing, as you, Congressman Zablocki, have pointed out, is a constructive way for Congress to go about influencing the formulation of foreign policy vis-a-vis the executive branch. It is appropriate for the Senate and the House to advise the President on the directions U.S. foreign policy should take in the future by stating principles and policy goals.

RESOLUTIONS CONSISTENT WITH ADMINISTRATION INITIATIVES

The resolve section requests the President to inform foreign countries of specific declarations of policy by Congress. That is a positive approach. The objective is to give the President guidance and clearer understanding as to the position of Congress. Goals are set for future negotiations that logically relate.

It is important to stress that the resolutions provide a statement of principles and policy goals, in the hope that we can at least influence and at most guide what will actually happen down the negotiations road.

Three: Our resolutions, it should be noted, are consistent with the nuclear initiatives of the present administration and its predecessors. There is nothing inconsistent with anything done by this administration or its predecessors. Section 4 of both resolutions endorses Secretary Kissinger's recent proposal at the United Nations for multinational regional nuclear fuel cycle centers.

Four: The resolutions require a quid pro quo from the Soviets by insisting on parity and verification procedures. This is a way for Congress to make clear in a formal way that it expects an equitable arrangement with the Soviets in all arms control and reduction negotiations. I want to stress a particular point because it is a new point. The Senate resolution adds a new section 5.

Five: For providing the framework for the nuclear powers to offer incentives to the nonnuclear states to abstain from nuclear weapons in return for the ultimate peaceful benefits of nuclear energy.

IMPORTANCE OF "QUID PRO QUO ARRANGEMENTS"

While quid pro quo arrangements are required of the major nuclear powers, there are included genuine incentives for compromise on the part of states further down the nuclear totem pole. International participation in critical elements of the fuel cycle is offered in return for nations becoming full signatories of the Non-Proliferation Treaty and accepting International Atomic Energy Agency inspection—in a context that encourages political trust. In proceeding to increase the power of the international community, a step-by-step process is essential.

The operative hypothesis is that a seat at the table of nonweapons aspects of the fuel cycle is the price the monopolists must pay to others who agree to forgo a seat at the table of nuclear weaponry. To quote Secretary Kissinger, a new international structure has to be built "not on the sense of preeminence of two power centers, but on the sense of participation of those who are part of the global environment."

It is important to note that none of the steps proposed in the resolution require nuclear disarmament, a working collective security system, or total international ownership of nuclear goods.

EXPLANATORY MATERIAL SUBMITTED ON SENATE CONCURRENT RESOLUTION 69

In regard to the specific provisions of the resolutions, Mr. Chairman, I submit for the record the resolution I introduced in the Senate and an accompanying white paper explaining the reasoning behind the various sections of Senate Concurrent Resolution 69. I will also submit to you a memo setting forth the reasons for the changes or additions that we have made beyond the resolution that you introduced. I would like to say for a moment that we built upon the foundation of the truly monumental work that you did in introducing your original resolution.

We had more time to think about it because we followed you. I think we have come up with a few suggestions that strengthen what you have done and I hope you will give them careful consideration.

Mr. ZABLOCKI. Without objection, the copy of the Senate resolution, the white paper and subsequently the memo explaining the changes will be made a part of the record at this point.

[The information referred to follows:]

[S. Con. Res. 69, 94th Cong., 1st sess.]

CONCURRENT RESOLUTION

Resolved by the Senate (the House of Representatives concurring),

Whereas the operation of the Treaty on the Non-Proliferation of Nuclear Weapons was reviewed in May, 1975, by a special conference which included parties to such Treaty;

Whereas such conference confirmed the fact that states with nuclear-weapons capability have made only limited progress in pursuing "negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and a treaty on general and complete disarmament," as called for by such Treaty;

Whereas a significant number of non-nuclear weapons states have not acceded to such Treaty;

Whereas pressures generated by expanded energy requirements throughout the world have vastly increased the demand for non-military uses of nuclear energy;

Whereas it is important that further efforts be undertaken on an urgent basis to limit the dangers involved in peaceful and military nuclear developments and that the position of the United States Congress be understood with respect to its willingness to give full effect to the terms of the Treaty on the Non-Proliferation of Nuclear Weapons and to take further steps to limit nuclear dangers; Now, therefore, be it

Resolved by the Senate (the House of Representatives concurring), That the President of the United States is respectfully requested to inform the appropriate foreign countries of the following declaration by the Congress of the United States with respect to arms control and disarmament negotiations and the proliferation of nuclear weapons materials:

(1) The Congress of the United States, noting the principles of strategic parity embodied in the Vladivostok Accord of November 24, 1974, urges their prompt embodiment in a Treaty. The Congress further urges, after the conclusion of such a Treaty, immediate negotiations on a verifiable mutual 20 percent reduction in the number of strategic nuclear delivery vehicles and the number of strategic missile launchers equipped with multiple independently targetable reentry vehicles.

(2) The Congress of the United States urges a comprehensive agreement ending underground nuclear explosions under adequate verification.

(3) The Congress of the United States, in order to reinforce international actions to prevent the proliferation of nuclear weapons and other nuclear explosive devices, urges a halt on further transfers of nuclear fuel, technology, and equipment to any country which has not accepted International Atomic Energy Agency safeguards on all its nuclear programs or which by January, 1976, has not become a party to the Treaty on the Non-Proliferation of Nuclear Weapons, upon the condition that all major nuclear suppliers agree to a similar halt on such transfers.

(4) The Congress of the United States urges an agreement among the major nuclear suppliers providing that, with respect to the plutonium resulting from any transfer between countries of nuclear fuel, technology, or equipment, all reprocessing of such plutonium will be performed in multinational regional nuclear fuel cycle centers which are protected by the strictest possible safeguards.

(5) The Congress of the United States urges a halt in the production of weapons grade material for weapons use under an adequate verification system. Following implementation of this provision, the Congress further urges, in order to share American resources and to guarantee nuclear fuel as needed to satisfy the legitimate energy needs of participating countries, the sharing of access to, and the product of, the nuclear enrichment facilities of the major nuclear powers with all nations who sign the Non-Proliferation Treaty and accept International Atomic Energy Agency safeguards.

The Secretary of the Senate and the Clerk of the House of Representatives are instructed to send an authenticated copy of this Concurrent Resolution to the President of the United States.

AN ANALYSIS OF SENATE CONCURRENT RESOLUTION 69 ON "NUCLEAR REDUCTION, TESTING AND NON-PROLIFERATION"

SECTION (1)

Description

Congress urges the prompt translation of the strategic parity principles embodied in the Vladivostok Accord (SALT II) into a treaty. After the conclusion of the treaty, Congress urges *immediate* negotiations on a *verifiable, mutual* 20 percent *reduction* in the *number* of strategic delivery vehicles and the *number* of missile launchers equipped with MIRV's.

Commentary

The final details of the treaty are scheduled to be agreed upon when Brezhnev visits the United States late this year. The Senate will then be asked to approve it. The chief feature of the treaty will be the *ceiling* placed on the number of vehicles and "mirved" launchers in the inventory of the two superpowers, 2,400 and 1,320 respectively.

The next step would involve numerical reductions in the actual number of vehicles and launchers in the inventory of both sides. Twenty percent is an arbitrary figure. If the ceiling figures under Vladivostok were actually built up too, the 20 percent reduction would result in 1,920 strategic delivery vehicles and 1,056 launchers equipped with MIRV's on both sides. However, assuming disparities in numbers and MIRV-installation rates between the two sides, the reduction would appear to "favor" the Soviets in total number of vehicles and the United States in total number of launchers with MIRV's, remaining.

Section (1) meets two complaints recently directed at the talks between Moscow and Washington. Concern has been expressed that the Vladivostok Accord would encourage a bilateral arms race to the agreed upon upper limits, with the Soviets having a head start over the United States in the number and kind of ICBM's. A related view is that SALT II represents only token progress, another cosmetic device, which does not promote meaningful reductions in strategic arsenals. Immediate negotiations toward a substantial reduction target would provide, potentially, a response to these complaints. This resolution, therefore, provides a constructive linkage between the ceiling of a SALT II Treaty and the reductions of a SALT III follow-on agreement.

Section (1) also speaks to the convictions of the great majority of signatories to the NPT who believe that there is a direct linkage between nuclear arms reductions by the superpowers and the prevention of the further proliferation of nuclear weapons to current non-nuclear weapon states. Article VI of NPT states: "Each of the parties to the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of a nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control."

The power of the U.S.-U.S.S.R. example is acknowledged in the international community. "Horizontal" non-proliferation must be accompanied by "vertical" non-proliferation. In strategic missiles alone on both sides, the number of deliverable warheads has increased nearly four-fold, from 2,600 to 8,000, in the seven years since NPT was signed. And these figures do not include thousands of tactical nuclear weapons and those delivered by bombers.

SECTION (2)

Description

Congress urges a comprehensive agreement ending *all* underground nuclear explosions under adequate *verification.*

Commentary

As bilateral talks with the Soviets proceed on SALT matters, talks on an underground test ban can proceed concurrently.

In 1963, the U.S., the U.S.S.R., and the U.K. signed the Test Ban Treaty banning nuclear weapon tests in the atmosphere, in outer space and under water. The parties agree "not to carry out any nuclear weapon test explosion, or any other nuclear explosion" in the designated areas, or in any other environment if the explosion would cause radioactive debris to extend beyond the borders of the state conducting the explosion. The treaty is of unlimited duration. Most of the countries of the world have now signed it, but not France and the P.R.C. (The latter two continue to test in the atmosphere.)

At the Moscow Summit meeting of July, 1974, the U.S. and the U.S.S.R. took the first step toward limiting *underground* tests by signing the "Treaty on the Limitation of Underground Nuclear Weapon Tests." Under the terms, each party agrees not to carry out any tests of *weapons* having a yield in excess of *150 kilotons* after *March 31, 1976,* to keep its underground tests to a minimum, and to work toward ending *all* underground *nuclear weapon tests. Verification* is to be by national means of detection. The accord provides for inspection by satellite photography and seismic readings of earth tremors. The two countries pledge to designate test areas in advance, to exchange geological measurement of weapons yield and to fire two "calibrating shots" so that standards of measurement could be set. (Critics charge that, set at 150 KT, the threshold is so high as to have little effect on the weapons programs of either the U.S. or the U.S.S.R.)

Article III states that the provisions of the treaty do not apply to nuclear explosions for "peaceful purposes," and that these "shall be governed by an agreement which is to be negotiated and concluded by the Parties at the earliest possible time." The decision not to have the treaty take effect before *March 31, 1976,* was in part determined by the need to give the two parties time to conclude this agreement. Negotiations are under way. (The treaty has not yet been submitted to the Senate.)

In the NPT, the nuclear powers obligated themselves to *share* the potential benefits of peaceful applications of nuclear explosions with non-nuclear states. Hence, agreed procedures for peaceful explosions, should these become technically and economically feasible, are also significant in limiting nuclear proliferation. (Article V of the NPT states in part that "potential benefits from any peaceful applications of nuclear explosions will be made available to non-nuclear weapon states Party to the Treaty on a non-discriminatory basis . . ." Further, "non-nuclear weapons states Party to the Treaty shall be able to obtain such benefits . . . through an appropriate international body with adequate representation of non-nuclear weapons states. Negotiations on this subject shall commence as soon as possible . . .")

Section (2) of this regulation urges a verifiable agreement ending *all* underground nuclear explosions on the part of states that have nuclear weapons. There is no threshold on yield, and no distinction is made between peaceful and military explosions (a distinction in motive is not provable, incidentally).

The value of peaceful nuclear explosions (PNE's) for engineering purposes is highly controversial. Various groups of U.S. scientists have tried hard recently to persuade their Soviet counterparts that on the basis of "Plowshare", PNE's are uneconomic, dangerous, and a spur to proliferation.

If a total ban on underground testing cannot be negotiated because of the belief of some states that PNE's may contribute to economic development, then perhaps an international PNE facility could be set up to handle tests as exceptions to an underground test ban. (The current U.S. position calls for "internationally approved facilities," national in nature.) Such a facility would not affect the stockpiles of nuclear weapons currently possessed, but it would give to countries who held back from signing the NPT on grounds of status and autonomy a greater sense of participation in a far less discriminatory system.

In any case, the United States can accept a comprehensive test ban without a threat to our nuclear deterrent or our security. (In the 93rd Congress, S. Res. 67, a resolution calling on the President to promote negotiations with the Soviet Union for a Comprehensive Test Ban Treaty was approved by the Senate Foreign Relations Committee—but no action was taken on the Senate floor.)

If the threshold test ban treaty does not cover peaceful nuclear explosions, and remains set at the high level of 150 kilotons, it will offer little incentive to any state to refrain from its own developments.

Note: On September 11 the Soviet Union put forward at the U.N. a draft for a treaty that would prohibit all underground tests of nuclear weapons as well as those tests prohibited by the 1963 Test Ban Treaty. Title: "A Treaty on the Complete and General Prohibition of Nuclear Weapon Tests." The test of the treaty states that it cannot become operative until it has the approval of *all countries with nuclear weapons* (U.S., U.S.S.R., U.K., France, China). Significantly, the text failed to provide adequate safeguards against secret underground testing. Nuclear explosions underground for peaceful and nonmilitary purposes are to be covered by "special agreement" according to the Soviets. The vagueness of this provision is an important objection because, w/o adequate safeguards, "peaceful" explosions can be used to develop nuclear weapons technology.

Note: In July 1975 it was announced after Kissinger and Gromyko met in Geneva that the Soviet Union had accepted the principle of on-site inspection of nuclear explosions in connection with the U.S.-U.S.S.R. underground threshold treaty. But the Soviets did not mention such inspections in the draft treaty submitted at the U.N. Instead, it calls for verification of compliance through "national technical means" and ask governments to assist by exchanging seismic data. It would appear that the Soviets have not become reconciled to on-site inspections under a comprehensive test ban. But Kissinger did say on Sept. 22 that the negotiations setting a threshold on underground tests constitute a significant step "towards a verifiable comprehensive test ban."

The Soviet Union has long advocated a total ban on tests, and the United States has long said it cannot agree to such a ban without on-site inspection, since a seismograph cannot distinguish between nuclear blasts and earthquakes or between weapon tests and blasts for peaceful purposes.

SECTION (3)

Description

Congress urges a *halt* by *all* major nuclear suppliers on further *transfers* (exports) of nuclear fuel, technology, and equipment to *any* country which has not accepted IAEA safeguards on *all* its nuclear programs *or* which by January has not become a party to NPT.

Commentary

At least eight suppliers would be covered by this section: U.S., U.S.S.R., U.K., France, Canada, West Germany, Japan, South Africa. Other potential suppliers are the Netherlands, Italy, Sweden. Prominent nuclear customers that could have been affected by such a provision earlier are Brazil, Iran, India.

Under Section (3), Israel and Egypt would have to sign on to NPT or come under IAEA in order to receive from the United States the 600 megawatt reactors offered by President Nixon. Incidentally, it is U.S. policy not to export the total fuel cycle (as West Germany has done with Brazil).

A halt on transfers would be an important first step in confronting directly the issue of proliferation. It is consistent with the cessation of underground tests and can be pursued simultaneously.

At the U.N. on Sept. 22, Secretary Kissinger called attention to new efforts among the *supplier states* to strengthen and standardize safeguards and controls on the export of nuclear materials, adding that commercial competition must not be allowed to erode safeguards. He repeated a U.S. proposal for "an international convention setting standards to protect the physical security of nuclear materials in use, storage or transfer."

SECTION (4)

Description

Congress urges an agreement among the suppliers to *reprocess plutonium* (resulting from transfers) in secure regional centers under multinational control.

Commentary

Plutonium which is sufficiently pure to be used in a light-water reactor—or a *bomb*—requires in most cases processing in a *chemical separation plant* that separates it from unspent uranium and other materials contained in fuel rods which have been irradiated in a reactor. For most of the reactors being built, where the spent fuel rods are reprocessed is where weapons-grade plutonium could also be produced. India has recently shown that plutonium need only be extracted from the spent fuel rods through reprocessing techniques that can be readily built on a small scale.

The number of spent fuel rods that will be moved about in the years to come is enormous. One estimate is that there will soon be between 7,000–12,000 shipments annually between reactors and reprocessing plants. By the early 1980's this will mean that the present *nonweapons* countries will have available to them annually enough Plutonium 239 to make 50 atomic bombs a week—if they chose to. (Kissinger: "The greatest single danger of unrestrained nuclear proliferation resides in the spread under national control of reprocessing facilities for the atomic materials in nuclear power plants.")

Not many reprocessing plants have yet been built, due to expense. We have arranged to have recipients of fuel produced here to send their spent fuel rods for reprocessing to the United States (or in some cases a third country).

This is a good (early) time to rethink the system. On Sept. 22 Secretary Kissinger, drawing on a plan under discussion at IAEA, proposed—as "a major step to reinforce all other measures"—the establishment of "multinational regional nuclear fuel cycle centers." He argued that their existence would reduce the incentive for small and inefficient reprocessing facilities, limit the possibility of diverting peaceful nuclear materials to national military use, and create a better framework for applying effective international safeguards.

This concurrent resolution would *put Congress on record as endorsing the U.S. initiative at the U.N.*

A series of internationally controlled facilities, along with regulated transport of lethal material to and from plants, could represent "community" control of a process that is crucial to all—but is currently held by the nuclear "monopolists." A planned regional approach would reduce the danger of domination or capture and, more positively, spread control facilities and thus participation.

SECTION (5)

Description

Congress urges a halt in the production of *weapons grade material for weapons use* under a verification system. *If* this is done, Congress further urges the sharing of access to, and the product of, nuclear *enrichment facilities* (gaseous diffusion plants) of major nuclear powers with those nations who sign the NPT and accept IAEA safeguards.

Commentary

This section is the most unique feature of the resolution. It urges the nuclear weapons states to take a big step of statesmanship comparable to the Baruch-Lilienthal plan put forward by the United States after WW II. It might be termed the "open facilities" plan.

It can be put forward in international forums as a *target* to be pushed for down the road as the steps in Section 1–4 are realized. Looking ahead to a climate in which steps have been taken to share at least some important peaceful nuclear responsibilities and privileges, this step would provide the means by which the international community could get a handle on the basic element of the process—the uranium itself.

Weapons grade fissionable material is produced by power reactors and by military reactions. Under the first part of Section (5) the production of all fissionable material for military purposes in both types of reactors would be ended. If Congress approved this part of the resolution, it would be revitalizing the *1966 U.S. proposal for a "cut-off" in the production of all weapons grade material* and the transfer of substantial military stocks of U–235 and plutonium to peaceful uses.

Incidentally, *U.S. weapons needs* are presently consuming only a very small portion of the enriched nuclear fuels that we are capable of producing. A proposal to halt the production of weapons grade material for military purposes would probably not be favored by the *Soviet Union* at this time since they are now in the initial stages of an extensive MIRV program requiring manufacture of many new warheads.

The timing of the proposal may not be right but negotiations are never accomplished instantaneously. Besides, we are talking about an initiative to be suggested by Congress *now* to take effect over the *long term,* if other nuclear weapons states agree.

Coupled with the "cut-off" proposal in Section (5) is a proposal that would amount to the internationalization of enrichment plants. IAEA inspection could be performed at *all* nuclear power reactors using both U–238 and U–235.

At this time the *United States* has a virtual *monopoly* on enrichment facilities since we possess about 90 percent of the world's existing capacity. In contrast to the period of the Baruch-Lilienthal plan, however, the enrichment technology is one in which *both* the U.S. and the U.S.S.R. have achieved the required know-how—so this idea may be acceptable to the Soviet Union.

In addition to its symbolic effect, this plan would have the real value of guaranteeing nuclear fuel as needed to satisfy the energy needs of participating countries. Perhaps the driving force in the nuclear policies of the nations of the world—in the future—will be to guarantee that their energy needs are met, with weapons proliferation per se of secondary importance. Therefore, such an initiative by Congress could provide *the impetus* for a better climate in which to head off the slide toward uncontrolled proliferation.

COMPARISON OF SENATE CONCURRENT RESOLUTION 69 AND HOUSE CONCURRENT RESOLUTION 371

No attempt has been made to explore all the implications of each piece of legislation, nor has the more lengthy analysis done by your office on S. Con. Res. 69 (in the November 11 Congressional Record) been duplicated.

The preambles to S. Con. Res. 69 and H. Con. Res. 371 are essentially the same, with an addition in S. Con. Res. 69 recognizing the increased demand for peaceful uses of nuclear energy due to expanded requirements throughout the world.

Section (1)—dealing with the Vladivostok Accord and (3)—dealing with the restriction of nuclear exports to those countries which accept IAEA[1] safeguards on all their nuclear programs, and are parties to the NPT[2]—are essentially comparable in both resolutions. Section (2) in each case calls for a comprehensive agreement ending underground nuclear explosions under adequate verification, but the House version adds the condition that all other nuclear weapons states enter into such an agreement. The House resolution would therefore not necessarily be supportive of a bilateral agreement between, say, the United States and the Soviet Union.

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[1] International Atomic Energy Agency

[2] Non-Proliferation Treaty

Section (4) of the House resolution calls for an agreement among unspecified parties and does not make clear whether the agreement is to be with one or more nuclear supplier nations or, on a more universal scale, is to include recipient countries too. The latter possibility would be difficult to achieve, even more so than the former (see discussion below) whereas an agreement among the suppliers could be imposed regardless of the attitudes of the recipients.

The agreement called for in the House resolution deals with plutonium "for peaceful uses" resulting from transfer of nuclear fuel, technology or equipment. Transfers for military uses appear not treated in the resolution. With respect to the peaceful transfers, all plutonium to be recovered from the spent fuel (irradiated uranium) in question must be extracted and then stored and fabricated at regional facilities under multinational safeguards. While the requirement to carry out all these steps at one facility provides the benefit of keeping the recovered plutonium under secure safeguards during these stages of its existence, it presents some questions. For instance, the reference to fabrication could have the effect of cutting off U.S. fuel plutonium recovered from the customer's spent fuel unless the U.S. fuel fabricators could locate and operate in the regional facility. The term "facility" itself is not defined, however, so it could be interpreted as a location where different companies from various nations could all exist together, even if competing for the future markets. The wording of the House resolution does not make clear whether the "regional facilities" are to be multinational—i.e., owned and operated by an international directorship—or merely regional in service area and owned by an outside nation or by one of the service area nations. The question of control is thus left open.

The "multinational safeguards" are similarly not defined. Such safeguards could be those already existing within IAEA or Euratom, or they might be a new set to be worked out in the future.

The requirements that recovered plutonium be installed into nuclear reactors at the regional facility is physically impossible to achieve since presumably nuclear reactors are scattered throughout the regional service area and could not be brought to the facility to have the new fuel elements installed. Perhaps the intent of the House resolution would be for the multinational organization itself to deliver fabricated fuel and install it into power reactors among its client nations.

Section (4) of the Senate resolution calls for an agreement which would be much broader in its coverage, making no limitations with respect to peaceful or military uses of the plutonium. All plutonium would be covered, including that resulting from U.S. military exports to the major Western nuclear weapon nations, such as Britain and France. The functions to be performed in the multinational regional nuclear fuel cycle centers would be much more limited than in the House resolution, namely only the recovery of plutonium from spent fuel. Storage and fabrication of the plutonium presumably could be in any of the center's client nations, so the potential impact of the Senate version upon the international nuclear fuel market would be less than for the more restrictive House version. On the other hand, under the Senate version plutonium, once recovered, presumably would no longer be under the strict safeguards of the regional center. The term "multinational regional" center indicates that one nation would not own and control, but the question remains which group of nations do so—the nuclear suppliers or the nations of the region to be served, or a combination of both?

All of the provisions of Section (4) are to be effected through an agreement among "the major nuclear suppliers"—presumably the United States, Soviet Union, Great Britain, Canada, France, Japan and West Germany. It is not clear whether all of these suppliers would have to sign the agreement or whether a veto by one would prevent it from taking effect. Politically it seems that some sort of agreement along these lines might be possible—already the major suppliers have been conducting meetings in London on the broad question of safeguards against nuclear weapons proliferation through nuclear exports. France and Germany have reportedly opposed the U.S. proposal to establish regional facilities because of the problems of ownership and control.[3]

Section (5) of the Senate resolution, not included in the House version, calls for a halt in the production of weapons-grade material for weapons use under an adequate verification system. It does not define such material, which presumably means uranium highly enriched in the 235 isotope, uranium-233 and plutonium. The resolution likewise does not define or suggest guidelines for "adequacy". (A similar proposal was included in S. 2678, Senator Gravel's bill of November 17.) A cutoff of production of weapons-grade materials would have no strategic impact since the already large inventories of such materials possessed by the United States and the Soviet Union are many times the amount required to destroy the respective nations, and the materials are recyclable from one type to another.

Following a halt in production of weapons material (by the United States, Great Britain, Soviet Union, France and China), the resolution urges the sharing of access to and product of nuclear enrichment facilities of the world, but would limit this sharing to those nations that sign (not ratify) the NPT and also accept IAEA safeguards. The world's enrichment facilities at the moment are found primarily in the United States and the Soviet Union, with some small installations in Great Britain, France, presumably in China, and some prototype factories for a new enrichment process (the centrifuge process) in Great Britain and the Netherlands. It is not clear what priority non-weapons NPT states would have for such access in comparison with enrichment needs of the supplying nation. Also considering the commitment of the weapons states under the NPT to share benefits of nuclear energy with non-weapons states, it is not clear what additional incentive this provision would provide for the stopping of production of weapons materials. Moreover, as noted above, the resolution does not extend the use of or disposition of present world inventories of nuclear weapons materials.

Practical aspects of the sharing proposal remain to be worked out in light of the fact that the United States facilities are already booked up for the next 10–15 years and the fact that it takes some five years to build any major new addition. "Access" to the recipients of a sharing policy would thus be a long-term concept at best. Finally, the requirements of IAEA safeguards and NPT status would exclude nations such as Israel, which have not signed the NPT but to which the United States is currently supplying materials.

Senator CRANSTON. Just to briefly touch on what you have done, in the first section of your resolution, page 2, lines 8 and 9, you noted the positive steps embodied in the Vladivostok Accord. We used "noting the principles of strategic parity embodied in the Vladivostok Accord," recognizing the fact that makes the resolution slightly more acceptable and salable.

DIFFERENCES BETWEEN HOUSE AND SENATE RESOLUTIONS

In section 2, we strike the last two sentences and a part of the first sentence on lines 19 and 20: "If all other nuclear weapons states will enter into such an agreement." The reason we struck that is that we and the Soviets are making seemingly pretty good progress in negotiating our own agreements to limit underground nuclear explosions. There is no change in section 3. In section 4, there are no substantive changes, but we use the Kissinger language that he used on September 22 in making his proposal; we think it strengthens the appeal of this to the administration and perhaps to our Republican friends in the Congress. But there is no substantial change. Finally, section 5, which I have already outlined in some detail.

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[3] Some students of the situation, however, have seen the apparent conflicts among nuclear suppliers as a matter of economic competition (e.g., Steven J. Baker, Why Not a Nuclear Fuel Cartel? Arms Control Today, v. 5, November 1975)—i.e., the universally held political goal of restricting the spread of nuclear weapons has come into conflict with the equally desired goal of profitable exports (from the suppliers' point of view) and the need for nuclear energy (from the developing world's point of view). Any solution arrived at by the nuclear suppliers will therefore have to balance their economic interests against their political and foreign policy interests. Establishment of a cartel along the lines of OPEC could be one such solution.

I have made it clear to my colleagues in the Senate that I earnestly invite changes in the wording of the resolution that will improve it. I hope you will approach our resolution critically in this committee as you study both resolutions. I know we are trying to accomplish the same thing in both. I do not feel that any of the language in the Senate resolution is sacrosanct and let me express the hope that you will consider the further step outlined in section 5.

IMPORTANCE OF SECTION 1

Today, given recent developments, I would stress section 1 of both resolutions. It incorporates the spirit and intent of Senate Resolution 20 introduced early this year in the Senate by Senators Kennedy, Mathias and Mondale, and House Resolution 160 introduced in the House by Congressman Bingham and many members of your committee.

In short, what we are trying to do is to express support for the broad purposes of the Vladivostok Accord while stressing the necessity of immediately moving on to nuclear arms reduction negotiations between the United States and the U.S.S.R.

The latter point is a longtime concern of mine, Mr. Chairman. How do we bring the arsenals down? Back in 1972, the Senate adopted an amendment proposed by Senator Taft and me that urged the United States to begin "at the earliest practicable moment" strategic arms reduction talks (SART) with the Soviet Union and other nuclear powers.

But what most concerns me today, Mr. Chairman, are the press reports out of Moscow and Peking and other reports out of the executive branch that SALT II is in trouble and may not result in a treaty establishing some limits, even upper limits, on the strategic arsenals of the United States and the Soviet Union that incorporate principles of strategic parity.

MOVING FORWARD WITH SALT TALKS

Regardless of the fact that there are major differences between Moscow and Washington in trade, human rights, and diplomacy; regardless of the fact that "détente" provides no magic solutions to real differences in national interests, regardless of the fact that the United States desires improved relations with the People's Republic of China—we must not, we cannot allow the momentum of SALT to be slowed down and ground to a halt. After all, the overriding purpose of talks with the Soviet Union in the first place was to contain the nuclear genie in a bottle of restraint. We must keep this all important goal in mind and not abandon the quest.

Some officials in our own Government, and some in the Soviet Union, have come dangerously close to suggesting that the two major powers can engage in nuclear war "with cozy assurances to each that they will pulverize each other only up to a certain point"—as Norman Cousins recently stated.

That refutes the notion of what warfare is all about, which is to destroy the other side. If we are going to insert rationality into the situation, we have to prevent nuclear war from coming about altogether.

Prompt passage by Congress of this resolution is one means of encouraging the parties to move forward on SALT II while reminding them that SALT III (reductions) is a necessary followup.

Mr. ZABLOCKI. Thank you, Senator, for an excellent statement. We would be remiss if I did not express my deep appreciation for your kind remarks, not only to me as chairman, but to my colleague, Mr. Findley and the subcommittee as a whole.

EXPLORING SECTION 5

We of course are flattered that the Senate would take our resolution as a model on which to build. If there is room for improvement in the House version, and I think there is, we will fully consider the Senate version following these hearings.

You have anticipated my first question by providing for the committee the memorandum as to the differences. I would like to ask one question, however. On page 3 of your resolution, section 5 which is the new section, urges a halt in the production of weapons grade material for weapons. It further states that following implementation of this provision, the Congress would then urge sharing access to and the product of nuclear enrichment facilities.

The objective here is to persuade the nonnuclear weapon powers and those that don't yet have nuclear energy that we will do everything possible to assist them in developing the nuclear energy that can be derived from nuclear weaponry if they will forgo nuclear weapons. That is hopefully our way to have a quid pro quo with them and to reduce the danger of nuclear weapons being more and more on the loose in the world. To clarify, on page 3, line 25, I hope you would have no objection to amending your resolution as follows: "the Congress further urges in order to share American peaceful nuclear resources."

Senator CRANSTON. That would be a good improvement. I accept the amendment automatically and at once.

Mr. ZABLOCKI. Because the first sentence deals with nuclear weaponry and your second sentence deals with peaceful nuclear uses.

CONCERN OVER IAEA

Senator CRANSTON. That is a very fine improvement.

Mr. ZABLOCKI. I share the stress that you place on the IAEA. While visiting IAEA recently, we were advised that they are in woeful need of additional funds if IAEA is to be the vehicle for achieving greater peace, international cooperation and trust. I do not feel that IAEA is adequately enough staffed or funded to provide that important function. What would you suggest in the way of strengthening IAEA?

First of all, do you agree that they are understaffed and underfunded and that something must be done?

Senator CRANSTON. Yes, I do. I think they need strengthening. When I discussed this with Senator Symington, he expressed great interest in what we are proposing and sympathy and he raised questions about the strength of IAEA and said we should look at its weaknesses and find ways to deal with them. So you and he are embarking upon exactly the same course.

As to precisely how to do that, I don't know. He has not expressed his own views to me on that subject, but I think together we just look for ways to insure that it has more strength and that its decision will be observed, which is all important.

Mr. ZABLOCKI. Am I presumptive that the Senate is anticipating hearings on your resolution? How soon do you expect the Senate to hold hearings and have action on the Senate resolution?

STRENGTHENING THE IAEA

Senator CRANSTON. Let me add one point to the other question. Secretary Kissinger has recently called for that, too, for strengthening the International Atomic Energy Agency.

Mr. ZABLOCKI. He had no formula?

Senator CRANSTON. He has not given the details yet.

Mr. ZABLOCKI. I hope our hearings will produce some avenues to explore in that regard.

Senator CRANSTON. Senator Symington indicated that he would focus to a considerable degree on that particular point. As to when we will have the hearings, I don't know. He said that we will move toward them as soon as we can.

Mr. ZABLOCKI. You stated, Senator, or are quoted as saying that the Congress has become laggard. I hope the hearing on the Non-Proliferation Treaty will not fall into the category. You were also quoted as saying the White House was hesitant in coming to grips with the problem of nuclear proliferation. Why have we been so negligent?

Senator CRANSTON. First, let me say that I exempt you from that criticism. You have been out in front in a very wonderful way. I don't exempt myself. I have had a deep interest in this, but I haven't moved as swiftly as I might have liked to.

NEGLIGENCE: RESULT OF INVOLVEMENT IN OTHER MATTERS

I think part of it is that we—and the administration gets so involved in other matters, instant problems that we know we have to deal with and where there may be more instant solutions that we are talking about here that sort of overwhelm us and we put aside these long-range problems, although this is the most immense problem confronting us.

My effort through this resolution in which Senator Brock and Senator Mathias joined is in part just a means to focus attention on something we cannot avoid dealing with now.

Mr. ZABLOCKI. I want to commend you for being able to get bipartisan support for your resolution. We were not quite so successful on the House side.

Senator CRANSTON. I hope that you will be and I would like to stress that we not only had bipartisan support but diverse ideological support in getting together Senators Brock and Mathias, who represent two different views in the Republican party, and the breadth of support we have with six of the nine members of the subcommittee. I think this indicates the overwhelming support that we have.

Mr. ZABLOCKI. Thank you not only for your testimony but for your prod.

FOCUS OF RESOLUTION APPLAUDED

Mr. FINDLEY. I certainly welcome Senator Cranston to this subcommittee. What is being done in the executive branch is not nearly enough and so I applaud the focus of the resolution in the hearings.

I think the resolution can be improved. In fact, some improvement has already developed here and more will no doubt follow as we attempt to untangle these complex but important questions.

Senator CRANSTON. I would like that before we will welcome you as a cosponsor.

Mr. FINDLEY. We have been on many projects together and I salute your initiative and your constructive attitude in international problems.

Senator, how would you assess the utility of our tactical nuclear presence in Western Europe?

Senator CRANSTON. I have concerns about our tactical nuclear presence there. It certainly gives us strength beyond that which we derive simply by having as many troops as we have there and causes those who might aggress to think over very carefully the fact that they might be confronted by tactical nuclear weapons if they were found to be overrunning our troops and the other troops of NATO.

CONCERNS OVER TACTICAL NUCLEAR PRESENCE

My opinions are going to find expression in other initiatives that I hope to undertake in other resolutions shortly. I have not joined in the resolution that would call for a declaration that we will never make a first use because I am not certain that it would be wise to move in that direction, although I have been talking to Congressman Ottinger and I have the greatest respect for his concern and his push on this problem, which I think is an immense one.

I am deeply concerned about a fait accompli by the executive branch in moving to use tactical nuclear weapons without consultation with Congress; I am not sure that decision should be left in the hands of one man.

I am also concerned about whether or not we have adequate security over tactical nuclear weapons wherever they are and over a decision to use them that might be initiated without adequate consultation with the President, let alone with the Congress. I am not convinced that the security is adequate to prevent others from seizing and using those weapons for purposes other than what we intended them to be used for. So I have all of those very grave concerns about tactical nuclear weapons in Europe and elsewhere.

Mr. FINDLEY. Underlying the hearings we now have is the role of international institutions. The IAEA is one example. The United Nations is another. The North Atlantic Treaty Organization is another.

Do you think that existing international institutions are adequate in their framework to deal with the problems of proliferation?

Senator CRANSTON. No. We have worked together on international institutions at great length and over many years and I strongly feel that in this area of control of weapons, and in the resolution of international disputes, they need strengthening.

Mr. FINDLEY. Thank you, Mr. Chairman.

Mr. ZABLOCKI. Thank you, Senator.

Senator CRANSTON. Thank you a great deal and thank you for pioneering and effective work.

Mr. ZABLOCKI. The next scheduled witness was to be our colleague, Mr. Bingham, but he is unavoidably delayed. Congressman Long, would you care to proceed?

STATEMENT OF HON. CLARENCE LONG, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MARYLAND

Mr. LONG. I am pleased to appear before this distinguished subcommittee and its able and respected chairman and ranking minority member.

I will say I am also delighted at the interest that the committee is taking on this very important problem. The executive branch lacks a policy for combating nuclear proliferation resulting from U.S. exports of nuclear technology and nuclear fuel. I support House Concurrent Resolution 371 as a necessary step toward remedying this lack by stipulating the suspension of nuclear exports to countries that do not accept International Atomic Energy Agency safeguards on all their nuclear problems and by urging the creation of regional nuclear fuel centers as a means of providing multinational control.

My brief statement will suggest several actions with regard to nuclear exports in addition to those called for in House Concurrent Resolution 371, and they are as follows:

(1) Congress should urge the administration to close loopholes in our international nuclear agreements that would allow other countries to produce nuclear bombs using U.S. reactors.

(2) Congress should urge the suspension of nuclear fuel exports to countries that are exporting nuclear weapons capability—in the form of enrichments and reprocessing plants—to third countries who have not accepted measures to prevent their development of nuclear weapons.

(3) Congress should urge the administration to seek the cooperation of the Soviet Union in stopping the exports of enrichment and reprocessing plants.

(4) Congress should urge the acceleration of efforts to strengthen international nuclear safeguards.

Congress should urge the administration to close certain loopholes in our present agreements under which nuclear material and technology are provided to countries that are not parties to the Nuclear Non-Proliferation Treaty.

Nuclear weapons are made from plutonium, or highly enriched uranium. Plutonium is produced as a byproduct in nuclear reactors. Although our nuclear agreements forbid the plutonium made in U.S. reactors from being used to make nuclear bombs, some agreements do allow plutonium produced in U.S. reactors from non-U.S.-supplied fuels to be transferred to third countries without United States approval in return for other "laundered" plutonium.

DANGER, "LAUNDERED" PLUTONIUM

This "laundered" plutonium could then be used for a nuclear bomb. In this way, a country could build a nuclear weapon using our reactors without violating, at least technically, its nuclear agreement with the United States.

Our nuclear agreement with Spain, for example, contains such a loophole. Spain has two U.S. reactors in operation, six reactors under construction, and a small plutonium reprocessing plant. Possible partners which Spain could use for laundering plutonium are South Africa, Argentina, or India. South Africa has developed its own uranium enrichment process and thus can produce weapon-grade uranium, which could be swapped to Spain for plutonium. Argentina and India both have reprocessing plants for the separation of plutonium.

The United States ought to revise its nuclear agreements, where necessary to forbid U.S. reactors from being used by foreign countries to produce nuclear weapons regardless of whether the nuclear fuel is supplied by the United States.

France and West Germany are currently exporting to Brazil and Pakistan enrichment and fuel reprocessing plants—plants which can produce nuclear weapon-grade material. Neither Brazil nor Pakistan has ratified the Nuclear Non-Proliferation Treaty, nor has either agreed to place all its nuclear facilities under International Atomic Energy Agency safeguards.

SUSPENSION OF U.S. EXPORTS ADVOCATED

Congress should call for suspension of U.S. nuclear fuel and equipment exports to countries like France and West Germany. West Germany and France depend on the United States for the great part of their nuclear fuel supplies—86 and 62 percent respectively—and will continue to depend on sources outside those countries until the 1980's.

I might point out that under the agreement made with Brazil, Germany was able to win contracts away from American exporters who were much more restricted in the kinds of facilities that they could offer. The German-Brazilian deal has therefore handicapped our nuclear energy export industry.

So often we say if we don't sell certain items, other countries will sell them. However, in this case, other countries rely on us for enriched uranium fuel and will for some years, fuel which is used for electric power to run their domestic industry. The cutoff of fuel supplies would therefore threaten these countries with the shutdown of their nuclear power reactors and the loss of electric power needed to run some of their domestic industry.

Although the U.S. controls the greatest portion of nuclear fuel-making capacity available to the free world, the Soviet Union may also be capable of supplying substantial quantities of nuclear fuel. Just how much, we don't know.

COOPERATION OF U.S.S.R. NECESSARY FOR CONTROL

The Congress should urge the administration to seek the cooperation of the U.S.S.R.—cooperation which may not be impossible to obtain, in view of the leverage we have by virtue of Soviet need for our grain and in view of the fact that the Soviets have been more conservative than the United States in supplying nuclear technology and fuel to other countries. For example, only after Libya ratified the Non-Proliferation Treaty did the U.S.S.R. agree to supply Libya with a small research reactor. It is the United States which must bear major responsibility for nuclear proliferation.

As part of this cooperation, the United States should seek Russian agreement to refuse nuclear fuel or equipment to countries that have not—at the very minimum—concluded a comprehensive nuclear safeguards agreement with the International Atomic Energy Agency. The United States and the Soviet Union working together could require other suppliers to follow the same rule. The reason the two superpowers ought to work together is because we both ought to understand that if nuclear war broke out we would be the main targets.

Present international nuclear safeguards provide little, if any, security against theft or diversion of nuclear weapon material and against sabotage of nuclear facilities. Argentina has reportedly—Newsweek, July 7, 1975—been able to divert 50 kilograms of plutonium—enough for 5 to 10 nuclear bombs—from a supposedly safeguarded reactor, without detection by International Atomic Energy Agency inspectors. The Agency has denied this charge. But I think we have run into many denials of that sort which later turned out to be somewhat disingenuous.

This report—attributed by Newsweek to U.S. intelligence sources—is disquieting, especially since Argentina has a plutonium reprocessing plant and since her leaders long ago expressed the desire for nuclear weapons.

APPEAL TO ADMINISTRATION TO IMPROVE IAEA

To strengthen international safeguards, Congress should urge the administration to accelerate efforts to build up the International Atomic Energy Agency through improved inspection procedures and equipment, more and better-trained inspectors, and authority to impose physical security standards at all nuclear facilities.

Congress should insist that the executive agencies and departments take seriously the threats involved in our nuclear exports. The State Department recently dismissed the dangers of exporting 130.5 kilograms of plutonium—enough for over 10 nuclear bombs—to Italy, with the obscure statement that Italy could deter, prevent, or respond to any attempt to steal the plutonium. How well Italy would be able to protect its plutonium, I don't know, since it hasn't been very successful in protecting its art treasures.

In two other cases, the State Department discounted the dangers of shipping over 90 metric tons of unriched uranium fuel to India and Korea by saying that the question of physical security arrangements in those countries was "not applicable, since it"—the fuel shipment in question—"is * * * low enriched uranium, which is not a nuclear weapon material."

IF NUCLEAR PROLIFERATION REMAINS UNCHECKED

However, as a report submitted to the administration over 8 months ago points out, terrorists could take over and blow up a reactor. This would release much deadly radioactivity, contaminate thousands of square miles, and cause thousands of deaths.

If unchecked, nuclear proliferation may soon lead to nuclear weapons in the arsenals of dozens of countries. The United States could someday be hit by a nuclear attack and not know who its attacker was. In the bewilderment of multiple possible assailants, our nuclear arsenal would have no deterrent effect, for we would not know whom to strike back at. We might even strike back at the wrong country. That, of course, might even be the idea of someone who hit us—to provoke us to strike back at the wrong country.

The dangers to the United States and to the world of not finding the means to check nuclear proliferation are incalculable.

This concurrent resolution is an important—a necessary—step toward reformulating and updating U.S. nuclear policy. I hope the subcommittee finds my suggestions helpful.

Mr. ZABLOCKI. Thank you, Mr. Long. We will fully consider the suggestions in your statement and I think they will be helpful even if we don't adopt them. But I think your suggestions do provide food for thought.

IAEA RECOMMENDATION PROVIDES FOOD FOR THOUGHT

In reference to your recommendation that IAEA be strengthened, are you implying that the United States has not effectively used its available leverage with IAEA or is it more a question of not having adequately supported the agency?

Mr. LONG. That is a little puzzling to me. When I was abroad several months ago, I was told that the IAEA had inadequate inspection personnel then. There just weren't nearly enough to do the job.

[The following material was subsequently provided by Mr. Long:]

At present, the International Atomic Energy Agency has substantially less than 100 inspectors for the almost 400 nuclear facilities subject to safeguards. The number of inspectors will have to expand rapidly.

Inspections take place at three-month or longer intervals and include mainly accounting measures. There are serious questions (1) as to the adequacy of current inspection procedures, especially for new types of reactors (such as the Canadian CANDU reactors) and other nuclear facilities; (2) regarding the question of who inspects the inspectors to protect the integrity and quality of the inspector force; and (3) regarding the adequacy of physical security measures, for which the International Atomic Energy Agency has no responsibility at present.

Mr. ZABLOCKI. We have some interesting technology as far as detection, which supposedly is foolproof. I would expect that this would be made available to the IAEA?

Mr. LONG. Right—although I have never known any technology to be foolproof, and I would probably agree with the alarm that I heard expressed when I was in Brussels, that the main lack was inspectors. I do think you need people who can competently handle the instruments. Moreover, I understand that new types of reactors, such the Canadian reactor, and new types of nuclear facilities greatly complicate inspections.

Mr. ZABLOCKI. People with proper instruments.

Mr. LONG. I agree, instruments. I would never argue that the IAEA shouldn't have all the technology it needs.

Mr. FINDLEY. Clarence, on page 3 you take exception with the State Department's argument that low enriched uranium is an unsuitable nuclear weapons material. Perhaps I misunderstood your point. Are you contending that low enriched uranium is a suitable weapons grade material?

Mr. LONG. The enriched fuel goes to a reactor. My point is that it goes to a reactor that could be attacked, and sabotaged. That would mean the release of radioactivity, contamination of thousands of square miles, and thousands of deaths.

FRENCH PROPOSAL POSES QUESTIONS ABOUT SAFEGUARDS

Mr. FINDLEY. On page 2 you say Congress should call for suspension of nuclear fuel and equipment exports to countries like France and West Germany. I presume you select France perhaps because it is not a signatory of the treaty. Is that reason enough?

Mr. LONG. The main reason is that France is arranging to export nuclear fuel reprocessing plants to countries like Pakistan that are not parties to the Non-Proliferation Treaty and that do not even have comprehensive safeguards agreements with the IAEA. Reprocessing plants can produce nuclear weapon material as can uranium enrichment plants. Germany is proposing to supply both types of facilities to Brazil which, like Pakistan, is not a party to the Non-Proliferation Treaty and has no general safeguards agreement with the IAEA covering all its nuclear facilities. Of course, both France and Germany, insist that the conditions they are attaching to these nuclear deals will prevent nuclear weapons development. However, once these countries get nuclear weapons capability, what good are conditions on agreements?

Mr. ZABLOCKI. On page 2 you said that the Congress should call for suspension of not only U.S. nuclear fuel, but equipment exports to those countries. Do you contend that or imply that France is using our equipment for transfer and resale?

Mr. LONG. Most of French and German nuclear technology, is licensed from U.S. firms. However, my point is that French and German dependence on us for their nuclear fuel gives us substantial leverage to affect their nuclear export policies. We should use that leverage.

REVISION OF NUCLEAR AGREEMENTS: SHOULD WE RENEGOTIATE EXISTING ONES?

Mr. FINDLEY. In the first full paragraph on page 2 you say "The U.S. should revise our nuclear agreements * * * to forbid U.S. reactors from being used by foreign countries * * *" I presume you refer to the future agreements, or are you suggesting the current renegotiation of existing agreements? Are you suggesting we try and renegotiate existing agreements to that effect?

Mr. LONG. I think we should, because we have so many agreements out, that if we just restrict our efforts to future agreements, we are just beating our arms in the air. It is a very sad thing of course, because as we all know at one time not too long ago we had complete control over all nuclear technology and materials. We just let the nuclear genie get out of the bottle and now it is going to be very hard to bring the genie under control.

Mr. FINDLEY. Do you think we could have kept it in the bottle?

Mr. LONG. Much more than we did or rather we could have released the knowledge more carefully.

Mr. FINDLEY. Thank you, Mr. Chairman.

Mr. ZABLOCKI. Mr. Bingham.

Mr. BINGHAM. I would just like to compliment Congressman Long on the excellent statement, most of which I am in full agreement with.

Mr. LONG. It is all I ever ask from a colleague.

Mr. ZABLOCKI. Thank you.

Mr. LONG. Thank you, Mr. Chairman.

STATEMENT OF HON. JONATHAN B. BINGHAM, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW YORK

Mr. BINGHAM. Mr. Chairman, I first of all would like to join in commending you for taking the initiative of convening these hearings and introducing House Concurrent Resolution 371, of which I am cosponsor, concerning the problem of nuclear proliferation. The problem of proliferation of nuclear weapons and sophisticated systems for delivering them to destroy potential enemy nations is a critical one. In fact, Ambassador Moynihan has stated in his view it is the most critical one facing the world today.

As House Concurrent Resolution 371 correctly suggests, many elements of a total solution to the problem of nuclear proliferation require new international agreements among nuclear and nonnuclear nations.

The most that Congress can do legislatively to help achieve such international agreements is to define the need and urge the executive branch to act creatively and with determination in pursuit of such agreements.

House Concurrent Resolution 371 makes a substantial contribution in that respect, and I am pleased to be among its cosponsors, although I feel that it will need to be refined as we proceed.

AREA THAT WARRANTS UNILATERAL ACTION

There is at least one area of the nuclear proliferation problem, however, where I believe unilateral action may be necessary, and where binding rather than advisory legislative direction may be appropriate. That is the matter of diversion of nuclear material and technology from peaceful to military uses by nonnuclear weapon countries and provision of such materials and technology to those countries by the United States and other technologically advanced nations. I would like to devote the remainder of my remarks to this problem and proposed legislation that might help remedy it.

As you know, six nations have exploded nuclear weapons. Fourteen nonweapon nations today operate power reactors and thus have the capability of producing an atomic bomb.

By the end of 1976, a number of other nations are expected to have nuclear power reactors which will provide them several hundred kilograms of plutonium each year—enough to manufacture several dozen medium-sized atomic weapons, among them, Brazil.

Most of these countries have signed and are adhering to the Nuclear Non-Proliferation Treaty which commits them to refrain from producing nuclear weapons. A few, however, have not—particularly Brazil, Argentina, Pakistan, and the Union of South Africa.

THE UNITED STATES AND NUCLEAR COOPERATION AGREEMENTS

The United States has nuclear cooperation agreements with many of these nonsignatory nations under which we provide certain nuclear materials—mostly power reactors and fuels. In most cases, these countries have entered into agreements with the International Atomic Energy Agency, the United States, or both for inspection and safeguarding of nuclear facilities.

But for non-NPT nations these agreements vary in scope and effectiveness. As the case of India clearly demonstrates, unless all the nuclear facilities of a nation are subject to inspection and safeguards, the possibility remains that materials can be diverted from peaceful to military purposes.

Nuclear weapons, however, cannot be efficiently produced unless nuclear enrichment or reprocessing facilities are available. Such facilities, therefore, must come under particularly strict control if the possibility of nuclear weapons proliferation among non-NPT nations which have not signed the Non-Proliferation Treaty is to be minimized.

WEST GERMANY'S AGREEMENT WITH BRAZIL

Controls on enrichment and reprocessing technology are already in danger of being breached. As has already been mentioned, West Germany has recently concluded an agreement with Brazil to provide as many as 80 nuclear plants over the next several decades.

In addition, the agreement provides for the sale of a uranium enrichment plant—the first transfer of this critical technology to a developing country and in this case, a country which is not a signatory of the Non-Proliferation Treaty. In addition, Germany, France and the Soviet Union provide enrichment and reprocessing services to other nations, including many nonsignatory nations.

By the end of the decade, conservative estimates suggest that civilian nuclear reactors in nonweapon countries will be producing as much as 20,000 kilograms of plutonium each year—enough for at least 2,000 nuclear bombs. How can we stop—or at least slow—this growing capability to produce nuclear weapons among countries which have not rejected development of such weapons?

The spread of natural uranium enrichment facilities must be stopped promptly. At least that is a goal that I think we should seek to achieve. We may be able to stop the export of nuclear enrichment technology by refraining from exporting that technology ourselves and by putting pressure on West Germany and the Soviet Union to refrain from exporting enrichment plants and services.

SPREAD OF URANIUM ENRICHMENT FACILITIES MUST BE HALTED

These pressures can be both direct, through bilateral channels, and multilaterally using available international organizations. In the case of West Germany we also have—for the moment at least—a strong "bargaining chip." West Germany and indeed all of Western Europe, are depending upon us for nuclear fuel for their powerplants.

Were we to cut off the supply of uranium to any country that exports nuclear enrichment technology, West Germany's nuclear plants would be without fuel and much of Germany without electricity.

It is a drastic threat, but the proliferation of nuclear weapons is even more serious. So I believe we should be prepared to refuse nuclear fuel and technology to any country which, like West Germany, proposes to export nuclear enrichment facilities to countries which have not signed the Nuclear Non-Proliferation Treaty. Parenthetically, I would like to point out that in the case of some countries, notably South Africa and Israel, that appear to be developing their own enrichment technology, I don't believe it would be practical or appropriate for us to forestall such independent technological efforts.

NEW BILL OPPOSES TECHNOLOGY TO NONPARTIES

To give substance to these recommendations I introduced yesterday in the House a bill, H.R. 10237. This proposed legislation amending the Export Administration Act would establish clearly the policy of the United States in opposition to providing any enrichment or reprocessing technology to any nation which has not signed the Non-Proliferation Treaty. It puts teeth in that policy by prohibiting export licensing of any such technology for such countries.

In addition, it would prohibit export of any nuclear fuel or nuclear power facility to any nonsignatory nation that has not at least agreed to have all its nuclear facilities—present and future—safeguarded against diversion to nuclear weapons through complete inspection by the IAEA, Euratom, or the United States.

Finally, and perhaps most urgent and important, my bill would cut off all U.S. nuclear supply—fuel, powerplants, enrichment and reprocessing plants and services—to any nation that makes enrichment and reprocessing available to nonsignatory nations.

The argument will surely be made—as it is with respect to U.S. weapons sales—that restrictions on U.S. nuclear exports will not prevent other nations from obtaining the nuclear supplies they need or desire.

It is true that virtually all nuclear supplies—fuels, powerplants, enrichment and reprocessing plants and services—are available from sources other than the United States.

But while the United States may no longer be the sole supplier of nuclear supplies and technology, it is still the dominant world supplier. That dominance will not last much longer.

UNILATERAL POSITION ADVOCATED

I believe that a firm U.S. position with respect to nuclear exports along the lines suggested in my bill would threaten sufficiently to inconvenience and disrupt the nuclear power plans of other nations as to have a major impact on their policies with respect to safeguards against diversion of nuclear material to nuclear weapons. I think taking such a posture on a unilateral basis might well inspire other nuclear nations, particularly the Soviet Union, to consider similar policies.

The State Department, through Secretary Kissinger, has indicated the policy of wanting to discourage the use of nuclear exports for proliferation of nuclear explosives. But other than that policy statement, the Department has done little to discourage other nations from exporting critical nuclear supplies to developing countries that have not signed the NPT. I think as we proceed in these hearings we will want to ask administration witnesses why it has not done more.

The legislation I have introduced, Mr. Chairman, would for the first time give the State Department a direct and effective voice on nuclear exports. The Secretary of State, in fact, would exercise final control over such exports pursuant to the foreign policy objectives of the Export Administration Act. For these reasons, I respectfully urge that this subcommittee seriously consider this legislative proposal in conjunction with House Concurrent Resolution 371.

IMPACT TO GERMANY FROM POSSIBLE CUTOFF

Mr. ZABLOCKI. Thank you for an excellent statement and I want to express my great appreciation for your counsel and certainly your efforts in preparing the resolution, House Concurrent Resolution 371.

I would just like to ask one very brief question. Both you and Congressman Long have advocated putting pressure on West Germany to the extent of advocating the discontinuation of nuclear assistance to that country.

What do you possibly see as the reaction on the part of Germany if we do so?

Mr. BINGHAM. Normally, I don't like this kind of pressure, but I think this is such a critical situation and such a particularly urgent one that I think we have to do that. Since we control the supplies, I think we are in a position to make that have an impact that would not follow the usual diplomatic course. Perhaps the very discussion of this type of action will be sufficient to create some kind of concern on the part of West Germany with regard to the policies they have embarked upon which indeed seem reckless to us.

Mr. ZABLOCKI. You have indicated there is need for refinement in House Concurrent Resolution 371. We would certainly welcome, John, your further advice and recommendations.

Mr. Findley.

Mr. FINDLEY. I want to join in thanking our colleague on his contribution here. It is a provocative statement.

You already raised the question I was about to raise as to the impact upon Germany, a valued ally, and I assume that the gentleman means it when he says we should cut off fuel to Germany if needed in order to prevent this export of technology?

Mr. BINGHAM. It so happens that Germany is one that would be affected. Of course, the application would be a general one. It would not be aimed precisely at West Germany.

Mr. FINDLEY. That would be shutting the lights off, wouldn't it?

Mr. ZABLOCKI. Thank you, Congressman Bingham. This hearing is adjourned until 10 o'clock Thursday morning, October 23, at which time our witnesses will be spokesmen from the Arms Control Association, the Coalition on National Priorities and Military Policy, and the Council for a Livable World.

[Whereupon, at 12:20 p.m., the subcommittee adjourned, to reconvene at 10 a.m., Thursday, October 23, 1975.]

NUCLEAR PROLIFERATION: FUTURE U.S. FOREIGN POLICY IMPLICATIONS

THURSDAY, OCTOBER 23, 1975

House of Representatives,
Committee on International Relations,
Subcommittee on International
Security and Scientific Affairs,
Washington, D.C.

The subcommittee met at 10:35 a.m., in room 2200, Rayburn House Office Building, Hon. Clement J. Zablocki (chairman of the subcommittee) presiding.

Mr. Zablocki. The subcommittee will please come to order.

We resume this morning the subcommittee's hearings on "Nuclear Proliferation: Future U.S. Foreign Policy Implications."

As noted at the start of these hearings, our concern is with the ever-increasing spread of nuclear technology. The issue to which we address ourselves is how best to control this growth so as to minimize its dangers and enhance its benefits.

This is clearly a difficult and complex question. Time is running out and the need is great.

Here today to help us find meaningful answers to the problem are representatives of three organizations which have had a deep and abiding interest in the subject. They are:

The Honorable Adrian Fisher, former Deputy Director of the Arms Control and Disarmament Agency and dean of Georgetown University Law School, testifying on behalf of the Arms Control Association;

Prof. George W. Rathjens of the Massachusetts Institute of Technology. Dr. Rathjens formerly served on the staff of the Special Assistant to the President for Science and Technology and for 2 years as Deputy Assistant Director of ACDA. He will present the views of the Coalition on National Priorities and Military Policy; and,

Mr. Carl Marcy, former Chief Counsel to the Senate Foreign Relations Committee and currently legislative consultant to the Council for a Livable World.

Mr. Fisher, if you will proceed please. And you will be followed by Dr. Rathjens and Dr. Marcy.

STATEMENT OF HON. ADRIAN FISHER, FORMER DEPUTY DIRECTOR OF THE ARMS CONTROL AND DISARMAMENT AGENCY AND PROFESSOR OF INTERNATIONAL LAW, GEORGETOWN UNIVERSITY LAW SCHOOL

Dr. Adrian Fisher was the dean of Georgetown University Law Center since 1969, and is currently on the teaching staff. Prior to this position as Dean of Georgetown Law Center, he was Deputy Director of the Arms Control and Disarmament Agency from 1961 to 1969. A native of Memphis, Tennessee, he received his LL.D. from Princeton University. Among the varied positions which he has held in government are those of Solicitor, Department of Commerce; General Counsel, Atomic Energy Commission; and Legal Adviser, Department of State.

Mr. Fisher. Mr. Chairman, I was privileged while serving as Deputy Director of the Arms Control and Disarmamant Agency to participate in the planning for and the negotiations of the Non-Proliferation Treaty, which went into effect in March of 1970.

I am going to summarize my statement that I have submitted.

Mr. Zablocki. Without objection, your full statement as well as your biographical sketch will appear in the record.

Mr. Fisher. Since I returned to private life I have kept in reasonably close touch with the progress of the treaty and have kept in touch through the Arms Control Association, with what is going on to keep the Non-Proliferation Treaty alive. This has included contact with people in other governments and also participation in the so-called "Preview" Conference on the Non-Proliferation Treaty which was held on a nongovernmental basis last fall in advance of the Review Conference in Europe.

SUGGESTED IMPROVEMENTS IN RESOLUTION OUTLINED

I find myself in this position, Mr. Chairman. I enthusiastically endorse the principles embodied in House Concurrent Resolution 371 but, as usual with a nit-picking "expert," I have certain suggestions which I believe would perhaps improve it. That perhaps indicates my return to academe where professors never agree with somebody else's formulation. That appears to be a disease. I hope you will take it in the spirit in which it is meant.

My first point, Mr. Chairman, deals with the first section of the resolution. One question is: should Vladivostok be put in the form of a treaty? I would wholeheartedly agree with that. If we consider ourselves bound by it, it ought to be either a treaty or an agreement approved by an act of Congress. An amendment now in the Arms Control and Disarmament Act actually proposed by Congressman Fountain and drafted in the old chamber of this committee off the gallery of the House, requires that.

We can't be committed to it unless we have a treaty or an agreement approved by an act of Congress.

Now, unlike one of my colleagues, I would approve the concept of the 20-percent reduction. As long as 13 years ago we proposed a 30-percent reduction. It does seem to me that a proposal for reductions might head off one of the possible disadvantages of the Vladivostok Accord, which set very high limits.

The accord really say the Soviets can do what they want to do and we can do what we want to do; they make it possible for us to plan what we want to do.

TERMINOLOGY IN SECTION 2 QUESTIONED

A minor additional point in the first section: there might be some question as to whether or not you should use the term "nuclear delivery vehicles" or whether you call it "strategic missile launchers" and "strategic bombers" to get into the terms of the problems of verifying missiles. I know your staff is as competent to deal with that problem of drafting as I am.

As for the second proposal in the resolution, the comprehensive test ban I think is long overdue. It is long overdue considering the state of the art of national means of verification. As I have indicated to this committee before, there probably are as many pounds of oratory in the early sixties or midsixties over my name and the name of my boss, Bill Foster, talking about onsite inspections as there are by anybody else. It probably was true that verification might require onsite inspection in 1963 and 1964 but it ceased to be true in 1967 or 1968. Clearly by 1975 we should go ahead with a comprehensive test ban.

REVIEW CONFERENCE CONCEPT OFFERED AS SUBSTITUTE

Here again the way I would like to improve your resolution—this is presumptious of me—is to suggest that the condition, if all nuclear-weapon states will enter into such an agreement, be modified somewhat. There is no question but a comprehensive test ban with the participation of France, China, and India would be better than one without them, certainly over the long run. On the other hand, I don't think—certainly for a period of time—participation in a comprehensive test ban, if only the Soviets agreed, would actually hurt our security interests even though the French, the Chinese and the Indians would present a slight problem.

We previously recommended some sort of review conference at the end of 5 years as a device to put the heat on the French and Chinese. You know, the French have been susceptible to that sort of thing. They are now testing only underground just as we are, even though they are not party to the Limited Test Ban Treaty. So, I have a feeling, Mr. Chairman, said with the greatest personal respect, that saying we don't do it unless we immediately get the French and Chinese in, has a potential destruct mechanism in it because they might say "We won't come in." Let us have a review conference at the end of 5 years to see whether or not the full participation by all nuclear powers is necessary for the continued security of the United States.

Personally I don't think that a comprehensive test ban would hurt us securitywise even though the French and Chinese do not join in the next 5 years.

SOVIETS DESIRE "PLOWSHARE PROGRAM"

Mr. ZABLOCKI. Do you anticipate the Soviet Union would agree?

Mr. FISHER. Yes, it would have to. The game would not be worth the candle if the Soviet Union didn't agree. The Soviet Union has indicated, made a proposal at the U.N. to which as far as I know we have not responded. It presents one problem. Our old friend or enemy, depending on your point of view, is the "Plowshare" program. They seem to have listened to us a little bit too much and seem to want a very active "Plowshare" program. You know, "Plowshare" comes from reference in the book of Isaiah, beating swords into plowshares. I have a feeling someone ought to look at the third chapter of Joel in which the opposite is said. There they beat the plowshares back into swords and pruning hooks back into spears. Joel in this case is truer than Isaiah. The "Plowshare" program is technically indistinguishable from the weapons program.

Is it worthwhile to keep peaceful nuclear explosions alive to have a loophole in the test ban treaty which is as big as the treaty? I think the time has come, particularly with the limited value of "Plowshare," to say no dice.

SELLING OUR BIRTHRIGHT FOR MESS OF POTTAGE

Whenever a former official takes a position which is inconsistent with the position that he took as an official he has to admit it, apologize for it, and explain it. I supported "Plowshare" for a bit although in 1966 I took the position in Geneva that peaceful nuclear explosives were indistinguishable from a weapon as a nuclear matter and I think that is the case. I am not really eating crow on this one because it is a position I took all along. I also took the position with respect to article V of the treaty that we are going to comply with it, but if we decide it is worthwhile we will do it for our own interest.

We do not say we have resisted the notion of saying we have decided it is worthwhile. We had a strong caveat in 1966. I think the caveat has been resolved. If we permit peaceful nuclear explosions to kill off the comprehensive test ban we have really thrown out the baby with the bath water—I can go into metaphor after metaphor—selling our birthright for a mess of pottage. It is not worth it.

MODIFICATION SUGGESTED IN SECTION 3

The third problem in the resolution relates to the concept of limitation on the export to other countries unless they are parties to the Non-Proliferation Treaty or accept full IAEA safeguards. I fully support that concept. But I think if we took that position only if all other major nuclear supplies agree to a similar halt, the possibility of getting French cooperation on it would be very limited. It is hard to go to a Frenchman and say, "Please don't ship to people who are not parties to the Non-Proliferation Treaty." They will say, "Neither are we." Using the concept of requiring full IAEA safeguards seems to be a very wise approach by this resolution.

On the other hand, and this is a little tougher because of the pressures of trade and competition. If all the other major nuclear suppliers agree to similar halt on transfers, should you be that explicit in this case? I am inclined to recommend that the language be a little bit modified, that it constitute an attempt to persuade other countries to accept a similar halt on transfers and not say, "We will only do it if the French have given us their word in advance they will go along." It ought to be a sort of half-full approach rather than say, "We will do it only if the French say they will do it."

I have another problem in terms of time frame which is more precise than it is in the case of testing because you have direct economic competition. I would urge that it be in the form of urging this policy and attempt to persuade other countries to go along to make it a workable policy.

Now, the policy itself is essential. Right now our current situation is one in which we use nuclear goodies as a device to solve other problems like Egypt and Israel, but we run the risk that putting safeguards only on the particular things that we give may reduce the incentive for people to join the treaty.

MODIFYING LANGUAGE TO PROVIDE IMPETUS

We can build up a nuclear energy complex in a country, then if it gets nonsafeguard materials it goes in and makes a bomb. The Canadian-Indian experience is a classic example of that. What this resolution proposes, I think, is great. My only problem is that I think it might not be a bad idea to change if all other nuclear suppliers agree to a similar halt on such transfers, to calm that down a bit—that is bad English, Mr. Chairman, but with greatest respect to make it an impetus to get all other countries to agree to that. We start out first; if the other countries so undercut us to make it unworkable we won't do it. But we start doing it ourselves and try to persuade the other countries to cooperate. I am not sure we have approached the French on the problem of IAEA safeguards where they are sympathetic. Approaching them on the Non-Proliferation Treaty is doomed to failure because they have not signed, themselves.

They have said while they will not sign the treaty they will act as if they are members to it. So you can go ahead and start working them over, putting pressure on them under the IAEA safeguards concept. Maybe that is workable. I remember once, though, talking to a Frenchman in an unofficial capacity, asking if the French would be receptive to a policy that they would not supply nuclear assistance to a country unless all of its atomic matters were under safeguards. He said, "No, of course we would not. You would not buy that policy, why should we?" That was the shortest discussion, at least for me, in history. It was rather hard to answer that.

UNILATERAL EFFORTS COULD IMPEDE ACCEPTANCE

This resolution seems to me to be a strong step in the right direction subject to the possible phrasing of "We won't do it unless we have advance French approval of it." That gives them a little bit more. We ought to do it the other way around, try to make it workable with all other countries.

Mr. Zablocki. Of course, one of the political difficulties in our country is that if we do it unilaterally the acceptance is doubtful.

Mr. Fisher. We can say we will do it. The pressure from the Congress and Executive would be to do it for a period and to attempt to urge other countries, the other major suppliers to agree to similar policy so that our policy is workable so that we are not cutting off our own nose to spite our face while the other countries are doing it.

If we were to put it on the IAEA basis rather than the Non-Proliferation Treaty basis, and I don't mean to say anything unpleasant about the treaty I love, nevertheless I think it is an international negotiating matter, you stand a better chance if you make it under safeguards as far as the French are concerned.

MULTINATIONAL CENTERS ENDORSED

Having said that, I would express enthusiastic support for the fourth proposal, the concept of the multinational fuel cycle centers as one that really cuts down greatly the possibilities of cheating and makes it easier for the IAEA to insure safeguards because you have one pipeline. It is easier to look at one pipeline that to look at a whole bunch of them. So I would give an enthusiastic three cheers for your urging of the multinational fuel cycle centers.

Now, in this context I am aware that there is currently considerable discussion of whether the IAEA is worthwhile. This is in part a discussion with a certain element of disillusionment with international organizations generally. I can understand that element of disillusionment. One merely reads the daily papers with respect to some of the statements made at the United Nations and other matters and you get a little tired of it.

I would hope, though, that if there is a general retrenchment on U.S. support for international organizations, which I would not like to see, but it may happen, that the IAEA be excluded from it.

I remember once when I was retained for the AEC as an investigator at Los Alamos I was introduced to the people at Los Alamos as an expert on congressional investigation. I demurred, I was not. The director at Los Alamos said, "Mr. Fisher, you may be no damn good but you are the best we have." I think IAEA is a good organization, given its political and economic reality. You can always make the worst case arguments on how you can cheat. You can make worst case arguments that the country can all of a sudden throw the people out. That is true of any agreement we enter into. Even our most rigorous provisions for onsite inspections proposed in Geneva in 1962, always faced the possibility that the Soviets could say "Sorry, you can't come in."

SUPPORT EXPRESSED FOR IAEA

One assumes that that rejection is recognized by the world as a rejection and a repudiation of any obligations under the treaty.

My own view is that we ought to still support and build up the IAEA, Mr. Chairman, on the ground that it is an international organization that has some 100 member states where we and the Soviets have worked out an arrangement with a few where there is no détente. We ought to improve it and say while it has problems let us forget about them. I am aware, based on our own experience, that there is a feeling that perhaps the promotional aspects of the IAEA diminish its effectiveness as a regulatory body. We, ourselves, have taken that position with our own former AEC and decided to split the two functions. It is a little harder to do it, though, when you have 100 nations, many of whom find the promotional aspect of the IAEA one of the principal reasons for supporting it. I think it is capable of supporting both functions.

Now, I would like, Mr. Chairman, if I may, in closing, to make two points.

INCLUSION OF "NO FIRST USE" CLAUSE

One is not in my prepared statement. That is the problem of should we have some form of "no first use" proposal. I must confess if we are trying to get people to join and support the Non-Proliferation Treaty but still insist that any form of restriction on bombing people with nuclear weapons is beyond the pale as far as U.S. policy is concerned, that seems to me to be a contradiction that makes even my relative tolerance of contradiction in a little short.

You know, you say, "Please agree not to develop nuclear weapons but of course if we want to bomb we will do it." I know the problems of no first use particularly when you have a NATO strategy that may be based on a use of nuclear weapons in response to an overwhelming conventional attack. No one is worried about the East Germans conducting that attack. There are various formulations that might be used. One formulation is except in an armed conflict which is conducted with the active cooperation or participation of a nuclear power. That would cover the problem of Europe.

You know, for a long time the military objected to this on the ground that there were the Chinese hordes. Now, they are a nuclear power. There are formulations to this. If the Executive could be urged to undertake to take an imaginative approach to that I think it would be helpful.

Now, we did have a recommendation on this at an unofficial conference at Divonne, France, conducted by the Arms Control Association, and they did come up with some recommendations on this subject. Their report also contains some comments on the issue of the multinational fuel cycle.

I would like to submit that report, if I could, for the record.

Mr. ZABLOCKI. That will be made a part of the record.[1]

Mr. FISHER. That is the end of my statement.

I am afraid I talked too long but I appreciate the opportunity to talk before the committee.

[Mr. Fisher's prepared statement follows:]

PREPARED STATEMENT OF HON. ADRIAN S. FISHER

Mr. Chairman and Members of the Subcommittee, my name is Adrian Fisher. I am a professor of International Law at Georgetown University Law Center and Vice President of the Arms Control Association. I was privileged while serving as Deputy Director of the Arms Control and Disarmament Agency to participate in the planning for and the negotiations of the Non-Proliferation Treaty, which went into effect in March of 1970. Since my return to private life I have continued to follow closely the progress of that Treaty, particularly since the formation of the Arms Control Association which has kept the problems of nuclear weapons proliferation and the arms race at the forefront of its list of priorities since its creation in 1971. This has included continuing contact with leading international experts on energy and weapons proliferation in and out of government and the participation in a "Preview" conference in advance of the NPT Review Conference in Europe last fall.

The Arms Control Association enthusiastically endorses the principles embodied in the proposed Concurrent Resolution. Preventing the further proliferation of nuclear weapons and preserving the Non-Proliferation Treaty are issues of paramount importance to the future security of the United States and the world. This Subcommittee rightly perceives that there are certain actions that must be taken in furtherance of these objectives, and in Concurrent Resolution 371 it addresses some of the most important of the steps that should be taken. This Subcommittee is to be congratulated for its initiative in this very important area.

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[1] These recommendations and conclusions are published in the Arms Control Association's publication entitled *NPT: Paradoxes and Problems,* and is reprinted in the Appendix on p. 351.

Having said this, however, I must add that in several important respects we would disagree with the precise formulations of the declarations proposed in the Resolution. We would also like to offer for the Subcommittee's consideration some additional comments which might be considered should the Subcommittee consider revising or amending its Resolution.

First, with respect to the declarations as set forth in Resolution 371:

1. SALT: We wholeheartedly support the Committee's call for a verifiable twenty percent reduction in the number of strategic launchers. Such a reduction would in no way affect our strategic security. I would point out that a thirty percent reduction was advocated by the United States over a decade ago, when force levels were considerably smaller than they are today.

I would also note a minor technical complication: The term "nuclear delivery vehicles" can encompass missiles as well as their launchers; a reduction in missile numbers would not be verifiable. It might be preferable to call for a "mutual twenty per cent reduction in the number of strategic missile launchers and strategic bombers, and in the number of strategic missile launchers equipped with multiple independently targetable re-entry vehicles." This would take care of the problem that missiles *per se* are not verifiable. The Subcommittee might consider adding to this declaration the proposal that the Congress call as well for restraints on qualitative improvements to weapons systems, in particular on further improvements in missile accuracy such as terminal guidance techniques. The Subcommittee might also consider recommending self-restraint on development of weapons programs not specifically prohibited by the Treaty.

2. Comprehensive Test Ban: The United States has officially favored an adequately verified Comprehensive Test Ban for many years. But nowhere, to my knowledge, has any organization of the U.S. government, whether Executive Branch or Congress, gone on record before in favor of the qualification "if all other nuclear weapons states will enter into such an agreement." I hope the Subcommittee will reconsider this requirement; which imposes conditions the United States has never insisted on before. A Comprehensive Test Ban without the participation of France, China, or India, would not be as effective over the long run as one which included all nuclear weapons states. But it is certainly true that for a number of years a CTB without their participation would not hurt the security interests of either the United States or the Soviet Union. There would be ample opportunity to review any changes in this situation brought about by continued testing on the part of France, China, or, for that matter, India. Furthermore, the adherence by the United States, Soviet Union, and Great Britain to a Comprehensive Test Ban would greatly increase the prospects for effective pressures of world opinion on those holdouts. We have some evidence of that phenomenon in operation already when you consider that France has been persuaded to begin conducting her nuclear testing underground, although France has never indicated any inclination to sign the 1963 Limited Test Ban Treaty.

But to insist that we would only enter into a Comprehensive Test Ban Treaty if all other nuclear weapons states jointed us is a position that until now has been taken only by the Soviet Union, and suggests only that they are not ready to talk seriously about a CTB. The latest Soviet proposal made at the United Nations earlier this fall has as yet to provoke any counter response, I might add, although in my opinion we should take advantage of their raising the question to produce a more forthcoming proposal of our own. One of the principal weaknesses of the Soviet position has been the loophole permitting peaceful nuclear explosions. It remains true that there is no technical distinction between a nuclear explosive used for a bomb and one used for peaceful purposes. PNEs at this point show so little promise that in my opinion it would be a serious mistake to let the eventual promise of peaceful nuclear explosions stand in the way of progress towards Comprehensive Test Ban. We should move now towards CTB without leaving open the peaceful nuclear explosions loophole.

Paragraph (3), related to nuclear supply policies, raises one of the same problems as the CTB issues. By providing that we restrict transfers of nuclear materials and equipment to those countries which have accepted IAEA safeguards on all their nuclear programs or which are parties to the NPT *only if all other major nuclear suppliers agree to a similar halt* has the effect of licensing the further erosion of the Non-Proliferation Treaty. We ran into this problem a year ago with the plan to sell large reactors to Egypt and Israel. Even though the safeguards conditions the United States announced it would impose appeared to be rather stringent they would not have applied to *all* peaceful nuclear facilities in those two countries; and since neither Egypt nor Israel then was or is yet a party to the NPT the proposed transactions would have made it more attractive for them to continue to withhold ratification. The important point to stress in this declaration, I think, is the significance of reaching a common supply policy agreement as soon as possible, but meanwhile to avoid placing ourselves in a position where we are in effect discriminating against parties to the Non-Proliferation Treaty.

Regarding paragraph 4, we wholeheartedly support the move towards encouraging the establishment of multinational regional reprocessing centers, and were pleased to see that the Secretary of State had made a statement to the United Nations encouraging such developments.

In an otherwise discouraging atmosphere it's rewarding to find such common interest in exploring the possibilities for the multinational fuel cycle centers. They've been under study by the IAEA, were endorsed at the NPT Review Conference in May, and I think Secretary Kissinger took a very positive step in endorsing the concept in his September 22 address to the General Assembly. Over the long run it's clear that there will be many problems to resolve in implementing these proposals; for example can they work on a purely bilateral or multilateral basis or should there be some sort of international supervision and control? Some people have suggested that they should be run by the International Atomic Energy Agency; others have very little faith in the IAEA as presently constructed, and considerable concern about its capability to operate effectively in the future when the magnitude of the control problem will be considerably increased. It may be that much of it can be done quite effectively by two or three countries in a region pooling their national resources under appropriate IAEA safeguards. In some regions, Latin American for example, existing regional mechanisms such as OPANAL may be more appropriate.

Mr. Chairman, I'd like to add a brief comment on the effectiveness of the International Atomic Energy Agency. The IAEA has been under increasing attack from many quarters, including some members of Congress who, finding that the Agency cannot prevent nuclear proliferation, conclude that we should withdraw our support from it. I disagree. I believe the IAEA does a competent job, within the limitations imposed by its statute and by political realities. IAEA safeguards systems are effective in monitoring the operation of nuclear power plants and there is no reason why they cannot be equally effective, in the future, as the scope of nuclear power programs grows, provided the Agency is given adequate financing. But to blame the IAEA for events outside its jurisdiction is unreasonable. IAEA has no enforcement powers; if a state operating nuclear facilities under IAEA safeguards suddenly announced "sorry, boys, you can't come into our plant any more," the IAEA would have to pack up and leave. But it would of course report this denial of access to the UN and the world. It would then be up to the world community to take effective action. Would IAEA's critics rather not even have the limited watchdog function that IAEA provides?

Thus, as far as its safeguards activities are concerned, I view the IAEA as not only an effective instrument, but a vital one.

Now, the Agency has been criticized as well by those who view its dual role of promoter and regulator of nuclear energy as an institutional weakness. There is something to that argument, but I would ask those critics if they would prefer to see the IAEA, with over 100 member states, abolished and replaced by a regulatory institution to which few would subscribe (and for which we would have to pay almost all the bills) and a promotional institution to which the developing countries would enthusiastically subscribe, because it no longer had any regulatory functions attached? In any event, "scrapping" the IAEA would mean amending the Statute, a move that might well introduce more undesirable features than it would resolve.

I would conclude with the hope that the real worth of the IAEA as a responsible and effective international agency, serving this country's and the world's best interests, be recognized, and that support for the Agency not be diminished in the mood of general retrenchment from U.S. support of international institutions.

Mr. Chairman, in closing, the Subcommittee might find helpful some of the recommendations which were put forth earlier this year in a publication of the

Arms Control Association and the Carnegie Endowment for International Peace called *NPT: Paradoxes and Problems*. This is the report of a conference we held a year ago in Divonne, France in anticipation of the NPT Review Conference. I particularly commend to the Committee the recommendations and conclusions and the accompanying "postscript on the nuclear fuel cycle" which are found on pages three through fifteen of the report. The points we raised in these recommendations/conclusions and accompanying "postscript" address many of the points raised in the Subcommittee's Resolution and expand in somewhat more detail on the points I have put before you this morning. Perhaps this portion of the report could be made a part of the record of these hearings.

Mr. ZABLOCKI. I would seek the advice of the subcommittee. If it is agreeable, perhaps we should hear the three witnesses and then ask questions of them as a panel.

Dr. Fisher, do you have time?

Mr. FISHER. Yes.

STATEMENT OF GEORGE W. RATHJENS OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY ON BEHALF OF THE COALITION ON NATIONAL PRIORITIES AND MILITARY POLICY

Born in Fairbanks, Alaska, Prof. George W. Rathjens received his Ph.D. from the University of California at Berkeley in 1951. Both scientist and educator, he has been professor of chemistry at Columbia and political science at MIT; and research fellow, Harvard. In government he has served as special assistant to the President for science and technology, and was chief scientist, Advanced Research Projects Agency, DOD. From 1961 to 1965 he was with ACDA as deputy director; deputy assistant director; and special assistant to the director. He has also served as director of the weapons systems evaluation division, Institute for Defense Analyses.

Mr. RATHJENS. Thank you, Mr. Chairman.

Mr. Chairman, members of the subcommittee, I welcome the opportunity to appear before you to comment on some of the problems of nuclear proliferation, arms control, and disarmament, and particularly on House Concurrent Resolution 371. I do so under the auspices of the Coalition on National Priorities and Military Policy. I should point out, however, that this testimony represents only a general position of the affiliated organizations. I would not want you to infer that all affiliates or organizations with the coalition fully agree with, or endorse, all points in my testimony.

Let me begin with the observation that it is wise and appropriate that the Congress take a greater initiative than it has in the past in formulating policy with respect to matters of military strategy, weapons development and procurement, and arms control and disarmament.

House Concurrent Resolution 371, and the Senate version, are important steps in this direction and should be supported. I do, however, like Mr. Fisher, have reservations about them. I do not think they go far enough, and would prefer if some of the proposals were not as conditional as they are on adherence by other states.

THREATS SEEN AS BASIS OF RESOLUTION

I will develop those points as I discuss the several proposals in detail in a moment, but before doing so I should like to make some more general remarks about the problems of arms control and disarmament. I do this, in part, because I read House Concurrent

Resolution 371 as having been based on somewhat different perceptions than mine of the threats we face and of the prospects for achieving arms control and disarmament through negotiations.

In thinking about nuclear weapons, I would suggest that it is useful to think of three different threats to us:

(1) The possibility that the Soviet Union—or much more remotely perhaps, China—might use nuclear capabilities deliberately, either politically or militarily, in conflict with the United States, or its allies, or otherwise to achieve objectives inimical to American interests;

(2) The possibility of accident or miscalculation that might result in nuclear weapons being used by the existing nuclear powers; and

(3) The threat of nuclear proliferation.

While some measures might contribute to the reduction of all three threats, with respect to others, there will be trade-off problems. The likelihood and risk of nuclear proliferation may be reduced at the price of increasing the other risks, and vice versa. Policy choices will depend, then, on the relative weight one attaches to the several risks.

LIP SERVICE PAID TO THREAT OF NUCLEAR PROLIFERATION

Since the demise of the Acheson-Lillienthal proposals, American policy has been dominated by concern about the first risk to the near exclusion of giving serious consideration to the other two. We have paid lip service to the third threat, nuclear proliferation, and to the second threat, the fact that we are sitting on a time bomb or are afflicted with a disease that could do us in, whatever the intent of political leaders. Meanwhile, our actions have been based almost entirely on concern about the first threat—a belief in the absolute necessity of maintaining nuclear strength vis-a-vis the U.S.S.R., preferably superiority. And Soviet attitudes appear to have mirrored ours.

The consequences of accepting this weighting are obvious and have been reflected emphatically in our and the Soviet approaches to arms control and disarmament. A dozen years ago we failed to conclude a comprehensive test ban treaty that might have contributed substantially to reducing the proliferation risk. This was because the United States and the Soviet Union were each concerned that if it gave a bit more on the verification question, its adversary might realize some advantage. And progress in SALT has also been slow because we have bargained hard and long over small points that, from the perspective of the dispassionate observer, must be dwarfed by the enormity of the nuclear cloud under which we live.

It is my belief that continuing on this course is unwise, particularly now that developments in technology make the acquisition of nuclear capabilities by other nations, and even subnational groups, ever easier.

OBJECTION TO VERIFICATION EMPHASIS EXPRESSED

It is with this background that I demure somewhat with respect to the emphasis on verification in House Concurrent Resolution 371. I would certainly prefer that we be able to verify Soviet compliance with arms control and disarmament agreements with high confidence—just as I favor maintaining capabilities for determining the status of Soviet weapons programs, whether or not we have agreements relating to them—but I believe that with respect to nuclear programs especially, there would be little risk even if our monitoring capabilities were imperfect. This is because Soviet overkill capabilities, and ours, are so great that most changes that might be made without our knowledge would not be very important. So I would not generally be as insistent on verification as I believe is the intent of House Concurrent Resolution 371; and, in particular cases, I feel it may be desirable to accept some risk of evasion if by so doing it will move us in the direction of reducing risks of the second and third kinds.

In the same spirit, and because of my concern about the proliferation threat particularly, I would like to see the scope of House Concurrent Resolution 371 expanded somewhat. Two suggestions particularly come to mind, both having their antecedents in a belief that it is desirable that we do more than we have to reduce the incentives for others to acquire nuclear weapons.

EXPANDING SCOPE OF RESOLUTION SEEN AS DESIRABLE

First, there is the issue of nuclear war-fighting and the development by the United States of weapons and doctrine for it, something which Secretary Schlesinger particularly has been advocating for the last year or so. Many in the Congress have, I gather, grave reservation about moving in this direction because they doubt that escalation can be limited and/or because they believe that even if it can be, there might be great damage to population in the event nuclear weapons are used, even if it is the intent of both the United States and the Union of Soviet Socialist Republics to destroy only military targets. I share these concerns, but in addition would argue that Secretary Schlesinger's proposals, and others that tend to make nuclear weapons more credible as instruments of policy, will almost inevitably increase incentives in the Third World to acquire nuclear weapons.

Second and related, there is the question of a pledge not be the first to use nuclear weapons. It is held by many that if the present nuclear powers would make such a pledge it would reduce incentives of other nations, particularly in the Third World, to acquire nuclear capabilities. But it is also argued that if the United States were to make such a pledge it might cause some of our allies to doubt our commitment to them—Germany is most often mentioned. Probably there is something to both arguments, but I should think some formulation of a no-first-use pledge might be developed that could help with respect to the Third World without it being very troublesome as regards NATO.

PRESIDENT'S ROLE IN NUCLEAR WEAPONS USE QUESTIONED

As a related point, it would seem to me we might reduce the threats of the second kind, that is, of miscalculation—and maybe of proliferation, too—by limiting somewhat the President's authority to initiate the use of nuclear weapons, if they had not been used against us. It has been suggested that this is at least as serious a matter as going to war, and that therefore, the Congress should be involved. One proposal, which I understand Senator Cranston is now advocating, would require concurrence by a group of specified leaders in the Congress before the President could initiate the use of nuclear weapons.

Let me turn now to the specific measures of House Concurrent Resolution 371, first to the proposal that 20-percent reductions in strategic delivery vehicles and MIRV-carrying missile launchers be negotiated immediately following the conclusion of a treaty based on the Vladivostok Accord.

Certainly such reductions would be welcome. However, I have reservations about the proposal—more serious than in the case of the other three proposals of the resolution.

PROPOSED REDUCTIONS SEEN AS MODEST

The proposed reductions are too modest. The levels from which they would begin are so high that the effect in reducing fatalities to be expected in the event of nuclear war would be very small: quite possibly, not even noticeable. And, if one is concerned about first-strike capabilities, and I am not but many people are, the result of a 20-percent force reduction is likely to be offset in less than a year as a result of accuracy improvements. Thus, what I would like to see is a call for something like a 20-percent reduction per year, continued for 5 or 10 years. After 10 years we would still have forces far larger than could be used for any rational purpose—more than 10 percent of what we now have.

But I have a more fundamental problem with any continuation of SALT, including trying to achieve 20-percent reductions. We ought to face up to the fact that, whatever the intent, the whole effort has now become as much an exercise in legitimizing the Soviet-American arms race as in limiting or ending it. There may still be a case for trying to negotiate those reductions, but if we choose to go down that path we had better recognize that there may be very large costs, perhaps exceeding the benefits.

FUELING ARMS RACE WITH BARGAINING CHIPS

If we strive for 20-percent reductions we may be as likely to fuel the arms race with bargaining chips—new, unneeded weapons programs—as to achieve the reductions. And, all the while we are negotiating we will almost necessarily be emphasizing to the rest of the world—indeed, in my view, almost certainly exaggerating—the importance of nuclear weaponry. Moreover, if the negotiations are prolonged, as seems likely based on the SALT record so far, the effect on the rest of the world is likely to be a reinforcement of the impression of Soviet-American unwillingness to take any risks vis-a-vis each other in the interest of really ending their continuing arms competition. These are hardly desirable effects if one is seriously concerned about the proliferation problem.

I am going to skip over my discussion of the test ban and transfers of nuclear reactors, technology and fuel because I agree entirely with what Mr. Fisher has said in his text and ad-lib comments. I guess I can also cut short what I have to say about extracting plutonium from spent fuel because I think we are in general agreement about that too. My only difference is that I don't see any reason why the resolution should be limited to plutonium for peaceful purposes. I say this because, with the amount of plutonium we now have in our stockpile, I see no reason for producing plutonium for anything other than peaceful purposes.

SENATE VERSION PREFERRED

Let me just summarize. I believe House Concurrent Resolution 371 should be supported, although I prefer the Senate version. I have reservations abouth both. In particular, I am skeptical about the proposal relating to strategic arms reductions; and would like to see greater emphasis on dealing with the nuclear proliferation problem, including especially doing more to reduce incentives for others to acquire nuclear capabilities.

Thank you.

Mr. ZABLOCKI. Thank you, Professor Rathjens.

[The prepared statement of George W. Rathjens follows:]

PREPARED STATEMENT OF GEORGE W. RATHJENS

Mr. Chairman, Members of the Subcommittee:

I welcome the opportunity to appear before you to comment on some of the problems of nuclear proliferation, arms control, and disarmament, and particularly on House Concurrent Resolution 371. I do so under the auspices of the Coalition on National Priorities and Military Policy. I should point out, however, that this testimony represents only a general position of the affiliated organizations. I would not want you to infer that all affiliates or organizations within the Coalition fully agree with, or endorse, all points in my testimony.

Let me begin with the observation that it is wise and appropriate that the Congress take a greater initiative than it has in the past in formulating policy with respect to matters of military strategy, weapons development and procurement, and arms control and disarmament. Resolution 371, and the Senate version, are important steps in this direction, and should be supported. I do, however, like Mr. Fisher have reservations about them. I do not think they go far enough and would prefer if some of the proposals were not as conditional as they are on adherence by other states. I will develop these points as I discuss the several proposals in detail in a moment, but before doing so I should like to make some more general remarks about the problems of arms control and disarmament. I do this, in part, because I read House Concurrent Resolution 371 as having been based on somewhat different perceptions than mine of the "threats" we face and of the prospects for achieving arms control and disarmament through negotiations.

In thinking about nuclear weapons I would suggest that it is useful to think of three different "threats" to us: (1) the possibility that the Soviet Union (or much more remotely perhaps, China) might use nuclear capabilities deliberately, either politically or militarily, in conflict with the United States, or its allies, or otherwise to achieve objectives inimical to American interests; (2) the possibility of accident or miscalculation that might result in nuclear weapons being used by the existing nuclear powers; and (3) the threat of nuclear proliferation. While some measures might contribute to the reduction of all three "threats", with respect to others, there will be trade-off problems. The likelihood and risk of nuclear proliferation may be reduced at the price of increasing the other risks, and vice versa. Policy choices will depend, then, on the relative weight one attaches to the several risks.

Since the demise of the Acheson-Lillienthal proposals, American policy has been dominated by concern about the first risk to the near exclusion of giving serious consideration to the other two. We have paid lip service to the third threat, nuclear proliferation, and to the second threat, the fact we are sitting on a time bomb or are afflicted with a disease that could do us in, whatever the intent of political leaders. Meanwhile, our *actions* have been based almost entirely on concern about the first threat—a belief in the absolute necessity of maintaining nuclear strength vis-a-vis the U.S.S.R., preferably superiority. And Soviet attitudes appear to have mirrored ours. The consequences of accepting this weighting are obvious and have been reflected emphatically in our and the Soviet approaches to arms control and disarmament. A dozen years ago we failed to conclude a comprehensive test ban treaty that might have contributed substantially to reducing the proliferation risk. This was because the United States and the Soviet Union were each concerned that if it gave a bit more on the verification question, its adversary might realize some advantage. And progress in SALT has also been slow because we have bargained hard and long over small points that, from the perspective of the dispassionate observor, must be dwarfed by the enormity of the nuclear cloud under which we live.

It is my belief that continuing on this course is unwise, particularly now that developments in technology make the acquisition of nuclear capabilities by other nations, and even sub-national groups, ever easier.

It is with this background that I demur somewhat with respect to the emphasis on verification in Resolution 371. I would certainly prefer that we be able to verify Soviet compliance with arms control and disarmament agreements with high confidence—just as I favor maintaining capabilities for determining the status of Soviet weapons programs, whether or not we have agreements relating to them—but I believe that with respect to nuclear programs especially, there would be little risk even if our monitoring capabilities were imperfect. This is because Soviet "overkill" capabilities and ours are so great that most changes that might be made without our knowledge would not be very important. So I would not generally be as insistent on verification as I believe is the intent of Resolution 371; and in particular cases I feel it may be desirable to accept some risk of evasion if by so doing it will move us in the direction of reducing risks of the second and third kind.

In the same spirit, and because of my concern about the proliferation threat particularly, I would like to see the scope of Resolution 371 expanded somewhat. Two suggestions particularly come to mind, both having their antecedents in a belief that it is desirable that we do more than we have to reduce the incentives for others to acquire nuclear weapons.

First, there is the issue of "nuclear war-fighting" and the development by the United States of weapons and doctrine for it, something which Secretary Schlesinger particularly has been advocating for the last year or so. Many in the Congress have, I gather, grave reservation about moving in this direction because they doubt that escalation can be limited and/or because they believe that even if it can be, there might be great damage to population in the event nuclear weapons are used, even if it is the intent of both the U.S. and the U.S.S.R. to destroy only military targets. I share these concerns, but in addition would argue that Secretary Schlesinger's proposals, and others that tend to make nuclear weapons more credible as instruments of policy, will almost inevitably increase incentives in the third world to acquire nuclear weapons.

Second and related, there is the question of a pledge not to be the first to use nuclear weapons. It is held by many that if the present nuclear powers would make such a pledge it would reduce incentives of other nations, particularly in the third world, to acquire nuclear capabilities. But it is also argued that if the United States were to make such a pledge it might cause some of our allies to doubt our commitment to them—Germany is most often mentioned. Probably there is something to both arguments, but I should think some formulation of a no-first-use pledge might be developed that could help with respect to the third world without it being very troublesome as regards NATO.

As a related point, it would seem to me we might reduce the threats of the second kind, i.e. of miscalculation—and maybe of proliferation too—by limiting somewhat the President's authority to *initiate* the use of nuclear weapons if they had not been used against us. It has been suggested that this is at least as serious a matter as going to war, and that therefore, the Congress should be involved. One proposal, which I understand Senator Cranston is now advocating, would require concurrence by a group of specified leaders in the Congress.

Let me turn now to the specific measures of House Concurrent Resolution 371, first to the proposal that 20% reductions in strategic delivery vehicles and MIRV-carrying missile launchers be negotiated immediately following the conclusion of a treaty based on the Vladivostok accords.

Certainly such reductions would be welcome. However, I have reservations about the proposal—more serious than in the case of the other three proposals of the Resolution. The proposed reductions are too modest. The levels from which they would begin are so high that the effect in reducing fatalities to be expected in the event of nuclear war would be very small: quite possibly, not even noticeable. And, if one is concerned about "first-strike" capabilities, the result of a 20% force reduction is likely to be offset in less than a year as a result of accuracy improvements. Thus, what I'd like to see is a call for something like a 20% reduction *per year*, continued for five or ten years. (After ten years we would still have forces far larger than could be used for any rational purpose—more than 10% of what we now have.)

But I have a more fundamental problem with any continuation of SALT, including trying to achieve 20% reductions. We ought to face up to the fact that, whatever the intent, the whole effort has now become as much an exercise in legitimizing the Soviet-American arms race as in limiting or ending it. There may still be a case for trying to negotiate those reductions, but if we choose to go down that path we had better recognize that there may be very large costs, perhaps exceeding the benefits. If we strive for 20% reductions we may be as likely to fuel the arms race with bargaining chips—new, unneeded weapons programs—as to achieve the reductions. And, all the while we are negotiating we will almost necessarily be emphasizing to the rest of the world—indeed, in my view, almost certainly exaggerating—the importance of nuclear weaponry. Moreover, if the negotiations are prolonged, as seems likely based on the SALT record so far, the effect on the rest of the world is likely to be a reinforcement of the impression of Soviet-American unwillingness to take any risks vis-a-vis each other in the interest of really ending their continuing arms competition. These are hardly desirable effects if one is seriously concerned about the proliferation problem.

I am happier about the comprehensive test ban proposal. It seems to me long overdue, and much to be preferred to the agreement already reached to conclude a 150 KT threshhold test ban treaty. I am particularly pleased to see that the language proscribes *all* underground nuclear explosions. I say this because there has been pressure from the Soviet Union to treat so-called peaceful nuclear explosions differently from weapons tests.

In advocating a comprehensive test ban I would hope that the Congress would not accept the Administration's contention that on-site inspections continue to be a necessary condition. In fact, such inspections would be of little value in assuring us of Soviet compliance with a comprehensive treaty. This is because, unlike the situation a dozen years ago, we now know that, if we can detect a seismic event by remote means, we can almost always also determine by those means whether it is a nuclear test or an earthquake.

I do have one reservation about the comprehensive test ban proposal of Resolution 371. I see no reason why it should be conditional on all nuclear weapons states acceding to it. Certainly, it would be preferable if they did. However, we could very safely forego testing for at least a decade even if China and France were to continue. Accordingly, I suggest that the resolution might be changed, accepting the Senate language or alternatively specifying that the treaty might be of limited duration if all nuclear weapons states were not party to it.

In a similar vein I would oppose making the third proposal of Resolution 371—to halt the transfer of nuclear fuel, etc. to countries not accepting stringent safeguards on all their nuclear facilities—contingent on other supplier states acceding to such an agreement. Again, we should try to get them to do so, but if we are not completely successful, we ought still to go ahead.

Finally, I come to the last proposal of Resolution 371, relating to the extraction of plutonium from spent reactor fuel. I agree that it would be highly desirable that this be done in international facilities under multinational safeguards. However, again I prefer the Senate version of the resolution to that of the House. I say this because I see no reason to limit the proposal to "plutonium for peaceful purposes", there being no other purpose for producing more plutonium of which I would approve.

In summary, I believe Concurrent Resolution 371 should be supported, although I prefer the Senate version. I have reservations about both. In particular, I am skeptical about the proposal relating to strategic arms reductions; and would like to see greater emphasis on dealing with the nuclear proliferation problem, including especially doing more to reduce incentives for others to acquire nuclear capabilities.

Mr. ZABLOCKI. Mr. Marcy.

STATEMENT OF CARL MARCY, LEGISLATIVE CONSULTANT TO THE COUNCIL FOR A LIVABLE WORLD

Mr. Marcy is currently Legislative Consultant for the Council for a Livable World. Before this current position, he was Chief of Staff, Senate Foreign Relations Committee for 19 years. Mr. Marcy graduated from Williamette University in 1934 (LL.D., 1960) and from Columbia University (LL.B., 1939, Ph. D. in international law and relations, 1943). He was a lecturer and instructor in economics, international law and relations, and public administration at Columbia and the College of New York from 1935 to 1942 when he joined the Department of State as assistant legal adviser and legislative counsel.

Mr. MARCY. Mr. Chairman, Dr. Charles Price who is chairman of the board of the Council for a Livable World and who is a great admirer of yours, asked to be excused from testifying this morning because he does have a class that he is teaching. So I am speaking on his behalf and behalf of the Council for a Livable World.

This organization was created in 1962 by the noted nuclear physicist Leo Szilard in response to the growing threat of nuclear war. We do support the Zablocki resolution because we think it is a first step in the right direction. We are proud that the council is a lobbying organization. We have registered our interest in the Congress and under the law and we are doing our best to persuade not only the Congress but the executive branch to move in the direction of control of nuclear weapons.

My comments will be much more general than certainly the skillful negotiator I have on my right, Mr. Fisher, and Dr. Rathjens who has worked on this subject for so long.

So far as the council is concerned, I would like, Mr. Chairman, for the record to insert at this point in my remarks the names of members of the council board of directors if I may.

Mr. ZABLOCKI. Without objection, your entire prepared statement will be inserted.[1]

Mr. MARCY. Yes. I also would like, Mr. Chairman, to insert at this point a brief description of how the Council for a Livable World works so that it will answer any questions that readers of the hearings may have with respect to what it does.

GRAVEST THREAT IS ONE OF NUCLEAR WAR

It is our firm conviction, that by far, the gravest threat to our economy and our way of life is the threat of nuclear war. In the nearly 200 years of American independence there has been no other threat anywhere with such dire consequences. We are concerned these days about ecology, food, energy, population, and of course all these things deserve the most serious attention.

The fact of the matter is, that these could be destroyed in a very short period of time if nuclear war were to break out. We do not believe that we can have a world safe for human civilization unless we can bring this under some reasonable kind of control. And because we think this resolution is the first stop in that direction we want to commend you very much for introducing it.

I have toyed in my own mind with the idea of how one ever manages to get the person in the street to be aware of the threat which does exist. We concentrate on these other things and move the nuclear threat to a back burner, if even there.

I have wondered sometimes whether it will require some horrible, terrible accident that will destroy a city, before we get the kind of attention that needs to be focused upon this problem. We have labored for years and years, as Dr. Fisher has told us here, going back to 1962 and even earlier, to try to bring these weapons under some kind of control and always we seem to fail.

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[1] Mr. Marcy's prepared statement, and description of the council may be found on p. 46.

SPECIALIZED LANGUAGE POSES PROBLEMS

Nuclear weapons and their control have become the speciality of people who have had to develop such a specialized language that the ordinary man cannot understand.

As a matter of fact, if you do not have this, Mr. Chairman, you certainly ought to get it. It is the revised edition put out by the Arms Control and Disarmament Agency of what they call SALT lexicon. It is 20 pages of description of what various abbreviations experts use and what they stand for. If you want to know what FBM stands for you can find out. It stands for fleet ballistic missiles. That is not quite right because you have to see ballistic missiles as it is described here. I was intrigued by the description of cold launch. "The cold launch. It is the technique of ejecting a missile from a silo before fuel ignition of the main engine, sometimes called the pop up."

After 20 pages of this kind of definition of the terms that are used, I had still one question left in my mind and that is whether the Russians agree to the same definition of terms that we do. I went back and read the preface. I see that it is described as:

> This lexicon is intended for quick reference only. Not as a basis for adjudicating definitional problems that might arise in negotiation or in final treaty or agreement language.

So, this small, specialized dictionary is good for our use to communicate back and forth, but not necessarily good for communicating with the people with whom we have to negotiate.

I am ashamed to say that too often the record seems to me to show that our nuclear policies are the result of the politics of a situation. A treaty will help someone get elected or we must have some signs of movement so that a summit conference can be held on schedule.

LEGISLATIVE BRANCH CITED AS BEING MORE FARSIGHTED

Mr. Chairman, it seems to me that Congress by and large have been more farsighted in examining some of these problems and in pushing for solutions than has the executive branch, whether it has been under the control of Democratic or Republican administrations. It is for that reason that we feel strongly that an initiative of the kind you have taken is one that is proper for the Congress.

I call attention to what I consider two unique aspects of the resolution before you.

In the first place, the resolving clause requests the President of the United States to inform the appropriate foreign countries of specific declarations of policy of the Congress with respect to arms control, disarmament negotiations, and the proliferation of these weapons. Too many Members of Congress have come to believe that foreign policy is made by the President of the United States. I do not believe this is true. Congress should not let repeated assertions by scholars or Presidents or members of the executive branch say that they make policy and have that become fact because it is repeated so often.

CONGRESSIONAL ROLE IN POLICY STATEMENTS LAUDED

The truth is that the President recommends policies to the Congress and the President's recommendations do not become policy until the Congress itself has acted. Take a look at the North Atlantic Treaty Organization, for example. The President recommended it; the Congress declared the policy. For those who work every year, year after year, on the Foreign Assistance Act, if you look at the first section of the act it reads very clearly that "Congress declares it is the policy of the United States" and then the law goes on to the specifics.

I emphasize again the action which you take here is significant. Congress should make policy statements of this kind on the most significant subjects that face the Nation. There is precedent for this course. During World War II the late Senator from Texas, Mr. Connally and Mr. Fulbright, when he was a member of this very committee, took the initiative in seeking a resolution declaring the intention of the United States to join a postwar international organization. This was done in part because of the failure of the United States to join the League of Nations after World War I and the immeasurable consequences of the repudiation of Wilsonian commitments.

Following that commitment in the Connally-Fulbright resolutions when the United Nations Charter came before the Congress it was approved with minor dissention.

RESOLUTION PRESENTS MORE THAN PIECEMEAL SOLUTIONS

A second aspect of your resolution, Mr. Chairman, is that it deals in a broad way and in one instrument with most aspects of the nuclear threat, not only from weapons but from their proliferation and from our failure thus far effectively to control the wastes from nuclear facilities.

At times in the past, and even now, there are resolutions before the Congress dealing with specific nuclear problems and that is fine and certainly the Council for a Livable World has no problem in supporting most of those resolutions.

We do believe they are piecemeal approaches, however, compared to the resolution before you. Admittedly your resolution is not a step-by-step approach. It is an omnibus resolution and that is what the council likes about it. It addresses the total nuclear problem as it affects our relations with other nations and our own security.

Now, some people may read this resolution quickly and damn it because they think it is a soft-headed approach to nuclear problems. It is not. We like the idea of your resolution which makes it clear that Congress is not proposing anything akin to unilateral disarmament. The resolution is a resounding declaration of what the Congress will stand for.

"NO FIRST USE" DECLARATION: IMPORTANT ADDITION

I would much rather see a resolution which has perhaps a little lower common denominator than some might like. I would like to see it go through with a whopping big majority instead of being rejected or going through by a very slim majority. Certainly some members of the council would go much further than this statement. We do believe that you subcommittee should give consideration to some of the items which have been suggested. Perhaps we should make a unilateral declaration that we would not be the first to use a nuclear weapon against a nonnuclear state. It is even possible that we could support a declaration that under no circumstances should the United States make first use of any nuclear weapon. Those are actions your subcommittee should consider.

Thank you very much, Mr. Chairman. It is a pleasure to be here in this capacity, I may say. For once I have the privilege of sitting in the front row instead of the back row where I sat for so many years with the Senate Foreign Relations Committee, and I like it.

[Mr. Marcy's prepared statement follows:]

Prepared Statement of Carl Marcy

Mr. Chairman, I speak on behalf of the Council for a Livable World. The Council was founded in 1962 by the noted nuclear physicist Leo Szilard, in response to the growing threat of nuclear war and the failure of the great powers to bring their weapons under control.

To this day, the Council's objective remains the same: to promote a U.S. military and foreign policy which will make the world a safe and livable place for all.

That is why we support the Zablocki resolution. It is a big step in the right direction.

The Council is a lobbying organization. We are proud to have registered our interest with the Congress in placing rational limits on nuclear and conventional weapons of all nations, including the United States.

Mr. Chairman, for the benefit of members who may read these hearings, I ask permission to insert at this point in my remarks the names of the distinguished Americans who serve on our Board of Directors:

Daniel Aaron, professor of English, Harvard University.

Ruth Adams, executive director, Illinois ACLU.

William von E. Doering, Mallinckrodt professor of chemistry, Harvard University.

Donald Eldridge, chairman of the board, International Video Corp.

Bernard T. Feld, professor of physics and former director of nuclear science, MIT.

Roger Fisher, professor of law, Harvard University.

Allan Forbes, Jr., producer-director of documentary films.

Maurice S. Fox, professor of genetics, MIT.

Jerome D. Frank, professor of psychiatry, John Hopkins University.

Matthew Meselson, professor of biology, Harvard University.

James G. Patton, past president, National Farmers Union, 1940–1966.

Charles Pratt, photographer, illustrator, with Rachel Carson, *The Sense of Wonder* (1975).

Charles C. Price, Benjamin Franklin professor of chemistry, University of Pennsylvania.

George W. Rathjens, professor of political science, MIT.

Eli J. Sagan, New York manufacturer; vice president, Fund for New Priorities in America.

Enid C. B. Schoettle, professor of political science, University of Minnesota.

I also ask permission to insert at this point an article from the *World Magazine* by Roger M. Williams, dated February 27, 1973, which describes the various activities of the Council for a Livable World.[1]

It is our firm conviction that by far the gravest threat to our environment, to our economy and to our way of life is the threat of nuclear war. In the 200 years of American independence there has been no other threat with anywhere near the dire consequences. Other concerns, such as those for ecology, food, energy, and population, are of course serious and deserve attention. But none of these can destroy our society within 30 minutes. Nuclear war can.

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[1] See article from World Magazine on p. 49.

We cannot consider we live in a world safe for human civilization until we have seen *all* nuclear weapons eliminated through agreement for genuine disarmament, with the necessary international institutions to assure compliance. The U.S. should be doing much more to lead the world in this direction, instead leading the world in the production of more and more weapons of nuclear destruction.

We commend Mr. Zablocki and his associates, therefore, for introducing a resolution vigorously urging U.S. initiative and determined effort in the first essential steps in this direction, a halt to further proliferation of these awesome weapons.

How can the person in the street—any street from New York, to Delhi, to Peking, to Moscow—be made so aware of the awesome danger all mankind faces as to force all political leaders to control the nuclear threat rather than let it control us.

It may already be too late. More and more frequently thoughtful people, aware of the danger, believe nothing can be done unless and until there is a terrible accident—an accident so stupendous as to destroy lethargy wherever it exits.

People of great competence and good will have labored for years to bring nuclear weapons under control. They have gotten bogged down in problems of verification, throw weight of delivery vehicles, does one count this or that, where is the line drawn between tactical weapons, and strategic weapons; between big bombs and little bombs.

The Arms Control and Disarmament Agency has found it necessary to publish a 20 page pamphlet merely to define the terms used in SALT negotiations!

Too often the record shows, I am ashamed to say, that nuclear policies are the result of the politics of a situation—a treaty will help someone get re-elected; or, some signs of movement are necessary so a planned summit conference can be held on schedule.

Is there anything short of an accident which might blow one of the world's great cities off the map that might waken mankind? Will mankind be wakened to danger by anything short of a terrorist holding a city hostage to the threat of a hidden nuclear weapon which, as we know, could be put together by a few advanced students of physics in any of the universities of the world, and carried in a suitcase? "Nuclear catastrophe", said Secretary Kissinger in July, "whether by plan or mistake, accident, theft, or blackmail—is no longer implausible".

Mr. Chairman, members of the Congress have a record in the area of nuclear controls of having been more far-sighted than Democratic and Republican administrations. Members have proposed such steps as the multilateral Limited Test Ban Treaty and the Nuclear Non-Proliferation Treaty. They have pushed for bilateral agreements with the Soviet Union, such as the ABM treaty. They have proposed a Comprehensive Test Ban Treaty.

The time has now come, we believe, for the Congress to assert its role of advising the President on the conduct of foreign policy with respect to protecting the national security from the multiple dangers flowing from the proliferation of nuclear weapons and from the vastly increasing use of nuclear means to generate power, with weapons grade plutonium, as easy by-product.

Congress also has a duty to advise foreign nations of the positions of the United States Congress with respect to such subjects as the Vladivostok Understanding and the proposed Comprehensive Test Ban Treaty. The Congress should make this nation's position clear with respect to the broad spectrum of nuclear problems which affect our relations with the rest of the world.

For these reasons, Mr. Chairman, we welcome and strongly support the initiative which you and your colleagues have taken in introducing H. Con. Res. 371, the subject of these hearings. We are happy to note that Senator Cranston and others in the Senate have followed your leadership.

Mr. Chairman, I wish to call attention to two unique aspects of the resolution before you.

In the first place, the resolving clause requests the President of the United States *to inform the appropriate foreign countries* of specific declarations of policy by the Congress of the United States with respect to arms control and disarmament negotiations and the proliferation of nuclear weapons materials.

Too many members of the Congress have come to believe that the policy of the United States is made by the President. This simply is not true. We should not let repeated *assertions* that the President makes policy become *fact* by repetition.

The fact is that the President *recommends* policies to the Congress. The President's recommendations do not become policy until they have been approved by the Congress or, in the case of treaties, by the Senate.

The President *recommended* that the United States adhere to the North Atlantic Treaty. The statements in the Treaty did not become policy and the supreme law of the land until the Senate gave its consent. For those who still may doubt that it is the Congress which makes policy, read the law—the Foreign Assistance Act of 1961, for example. That act clearly says "The Congress declares it is the policy of the United States," and so on to specifics.

Mr. Chairman, I have diverted briefly from my first point, namely, that this resolution requests the President to report certain policy statements of the United States *Congress* to other Governments.

There is precedent—significant precedent—for Congress to make policy statements on the most critical subjects which face the nation. For example, during World War II, resolutions by the late Senator from Texas, Mr. Connally, and by Mr. Fulbright while he was a member of this very Committee of the House of Representatives, declared the intention of the United States to join a post-war world-wide organization to preserve the peace.

Those resolutions were advance commitments on the part of the Congress as to what it would do in the future. Those resolutions were declarations of policy which gave the President guidance and authority to proceed with confidence in committing the United States to membership in the United Nations. After the Charter was negotiated it was approved by the Senate with only two dissenting votes.

We remind members of this precedent because members should recall the type of policy role the Congress has played in the past.

In summary, it is a congressional duty ot tell the President of the United States the metes and bounds of the nuclear policies which the Congress will support. It is also a legislative duty in a representative government, speaking through the President, to inform foreign nations of the basic attitudes of the United States Congress toward the ominous dangers posed by the practically unrestrained growth of the world-wide nuclear threat.

Mr. Chairman, a second unique aspect of your resolution is that it deals in a broad way and in one instrument with most aspects of the nuclear threat from weapons, from their proliferation, and from our failure thus far effectively to control the wastes of energy-producing nuclear facilities.

At various times in the past you have had before you resolutions which have dealt with specific nuclear problems. That is good. Several resolutions have dealt separately with the Vladivostok understandings, for example, or with a total test ban. These are worthy resolutions and the Council supports them. They are piecemeal approaches, however, to the overwhelming nuclear menace from so many directions.

The Congress should address itself not only to the Vladivostok Guidelines, but also to the proliferation of nuclear weapons, to ending underground nuclear weapons tests, to the disposal of nuclear wastes under strict multinational control, and to this nation's policy regarding the use of nuclear weapons against non-nuclear states.

Admittedly this is not a step-by-step approach. Clearly, a statement by this nation, on so important an issue is needed—a declaration of nuclear intention, if you will.

This is an omnibus resolution, that is what the Council likes about it. The resolution addresses the total nuclear problem as it affects our relations with other nations and our own security.

The time has come for the United States to declare its policies with respect to each of these issues.

For those who may be tempted by a quick reading of this resolution to damn it as unilateral disarmament, or something akin to a soft-headed approach to nuclear problems, one should note that the proposed statements of policy have running through them an absolute qualification.

The United States Congress will support these positions PROVIDED THAT all other nuclear weapons states will so agree.

For those who may believe that such a proviso makes the specifics of this resolution meaningless and not worth acting, we say, let's try it. Nothlng else has worked.

Some witnesses before your Subcommittee will undoubtedly argue that Section 2 of the resolution is a step backward because it has been U.S. policy for a number of years to agree to a comprehensive test-ban treaty with Russia *alone*, subject to adequate verification. That may have been U.S. policy, but that does not make it Russian policy; it does not make it world-wide policy applicable to all weapons states that now, or may in the future, exist.

Certainly the Council will support a comprehensive test-ban treaty with Russia alone. That would be a desirable first step.

Indeed, Mr. Chairman, we believe you and your colleagues should give consideration to going beyond the terms of your resolution. While we realize it may be impractical at this time, there should be careful analysis of the possible consequences of a declared unilateral cessation of nuclear weapons testing for a specified period of time. What would be the effect of a unilateral cessation of tests by the United States? Would it make the nation a second-rate power as some believe? Or, on the other hand, might a unilateral cessation of tests promote the principle of non-proliferation by other nations and promote a better atmosphere for negotiation of further reductions in the number of these weapons? Certainly new tests, new weapons, increasing threats have not been very successful as "bargaining chips" when it comes to bringing these weapons under control.

We also believe, Mr. Chairman, that your subcommittee should consider recommending to the President a policy of no first use of a nuclear weapon against a non-nuclear weapon state. You should also give consideration to recommending a no first use under any circumstances. While our military planners seem to believe that a few nuclear weapons might be used in special circumstances with no danger of escalation, the Council does not believe that to be the case. Recent studies undertaken by the Office of Technological Assessment in cooperation with the Department of Defense itself, and a study by the National Academy of Sciences, indicate that we have grossly underestimated the effects of the use of even a few weapons. Can anyone seriously believe that the first time a nuclear weapon is fired by any nation in anger that it will not have a disasterous affect on our society?

It is time for some nation, or somebody within some nation, to get the whole muddled bundle of nuclear negotiations off dead center—away from the rhetoric of experts so involved in the details that they can't communicate with citizens and, I fear, even with other experts.

The Zablocki resolution does this and the Council for a Livable World supports the resolution.

[From World Magazine, Feb. 27, 1973]

HARD CASH FROM TENDER MINDS[1]

(By Roger M. Williams)

In a rare accommodation of academics to politics, the Council for a Livable World finances pivotal Senate campaigns—and gets its men elected.

Like Albert Einstein, the late Leo Szilard was a scientist with a passionate concern for life as well as for science. Szilard, a Hungarian who fled from the Nazis to the United States, was a renowned physicist and the father of the nuclear chain reaction. At the same time he grew increasingly alarmed at the prospect of total war and nuclear destruction. For scientific discoveries such as atomic energy to be turned against mankind was, to him, the prostitution of science.

Szilard knew that this could be prevented only by controlling the cause of it: the political process. So in 1962 he set up, almost singlehanded, a group called the Council for a Livable World. Seldom has a lofty-sounding title been more receptive. Szilard had no patience with the hand-wringing, credo-issuing organizations so popular among academics. His group would concern itself with the implications of science in the arena of politics. It would undertake political action by making highly selective campaign contributions and by lobbying in Congress in pursuit of its primary goals: an end to the nuclear arms race and greatly scaled-down military expenditures by the major powers. In so doing, it would demonstrate a pragmatic single-mindedness rare among American liberals.

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[1] By permission of World Magazine.

The Council for a Livable World, now in the hands of Szilard's political followers, has achieved notable and unheralded success. The U.S. Senate, on which the council focuses, is a different place because of it. Twenty-seven members of the current Senate were elected with council help, and virtually all of them have been working actively to promote the goals that the organization espouses.

The council concentrates on the Senate because it reasons, rightly, that a single senator can have greater effect on issues of world peace than can any other individual outside the presidency. It concentrates on small-state Senate races because it reasons, again rightly, that the smaller the campaign budget, the greater the impact of a contribution to it; and as every grammar school student should know, senators from Rhode Island and Delaware—who benefited from council largess last fall—have votes equal to senators from New York and California, who did not.

Actually, the largess comes not from the council itself but from its 13,000 "supporters," political liberals who share the organization's concerns and are willing to make campaign contributions virtually at its direction. The supporters, many of them academics, are concentrated in the large states, so that a Senate race in, say, Colorado will involve few council funds from within that state—and anywhere between $10,000 and $50,000 from outside it. Other liberal lobbying groups, such as the National Committee for an Effective Congress, may contribute more money to a given campaign. Few if any contribute so much per supporter, and none does it by the council's direct grass-roots-to-candidate system.

In senatorial election years council supporters receive a series of mailings from the board of directors (who are virtually unknown to them) asking for contributions to the campaign of this or that candidate. The directors are so sure their recommendations will be accepted by the supporters that they control the flow of contributions simply by asking certain alphabetical groupings to send checks to certain candidates. "They are surprisingly good about that," says council board chairman William von E. Doering. "They'll give money to people they haven't heard about, on our recommendation."

If this sounds like a political dreamland, that is what Leo Szilard had in mind. Szilard envisioned a council of 150,000 members willing to contribute 2 per cent of their incomes to political campaigns. That proved unrealistic, but he quickly learned to make the best use of the money he had. For the 1962 campaign the council raised a mere $50,000. Szilard put $22,000 of it behind the senatorial candidacy of a young South Dakota professor named McGovern.

Since then the council's contributions have ballooned—to $375,000 in 1968. In 1972 the total was $232,000 a figure that political pros consider remarkable since the McGovern campaign was siphoning off most of the available "liberal money."

While the council has not produced any other presidential candidates, it has undeniably altered the composition of the Senate. Perhaps many of the council-backed senators would have been elected anyway, but it is important to note that the organization does not contribute to a campaign unless the outcome is in doubt; it does not back obvious winners or obvious losers, no matter how nobly progressive they are. Two other criteria are used: the candidate's need for financial support (no Kennedys need apply) and the nature of his opposition; although Democrat Joseph Clark had received support in earlier races for the Senate, he did not get it in 1968, because the council considered his Republican opponent, Richard Schweiker, equally sound on the critical issues. Thus far the council has backed only five Republicans, for the simple and predictable reason that Democrats more frequently meet its criteria.

Although the council's office is in Washington, D.C., its chief operatives are clustered in the intellectual environs of Cambridge, Massachusetts. Almost all of them are academics, and most are old associates of Szilard. President Bernard T. Feld, a physics professor at MIT, worked with Szilard on the Manhattan Project. Board member Maurice S. Fox, a genetics professor at the same institution, worked with him on other projects; so did Chairman Doering, who is a chemistry professor at Harvard. Board member James G. Patton, president emeritus of the National Farmer's Union, knew Szilard through the campaign to wrest control of atomic energy from the military. Feld and Doering form the core of the council's leadership, together with two other Cambridge neighbors: Roger Fisher, Harvard Law School professor and creator of "The Advocates" on public television; and Allan Forbes, Jr., self-trained anthropologist and producer of documentary films. It is a highly accomplished group that shares an updated Szilardian view of world affairs.

Obviously the council's thousands of supporters do not subscribe to that view *in toto*, but they do believe, as Feld expresses it, "that there remains a grave danger of nuclear disaster, that the policies of the United States are a major part of the problem, and that the one place where concerned citizens can have a real impact on it is the Senate—the only check and balance that remains in the international field."

The council's other major activity, besides supporting senatorial candidates, is lobbying. Again, the arena is the Senate, and the method is distinct. The council brings to Washington an array of authorities on the subject at issue and makes them available to senators. It finds that many senators are confused on complex matters of defense policy and that they welcome both the clarification and anti-administration point of view that the council's experts can provide.

Among politicians, the council has a reputation for low-key but persuasive presentations of its cases, and it has been instrumental in winning Senate victories on a number of hard-fought issues—the test-ban treaty, the extension of the life of the Arms Control and Disarmament Agency, the defeat of the Multilateral Nuclear Force. The council's greatest lobbying effort came in opposition to the Sentinel anti-ballistic-missile system. The system survived in the Senate by only one vote, and political observers credit the council with being the most effective contributor to the narrowness of the margin. Its ABM activities began in 1964 and continued right up to the time the climactic vote was taken, five years later. By its calculation forty-one of the fifty senators who voted against deployment of the ABM had participated in council-sponsored seminars.

A list of senators whose campaigns have been supported by the council reads like a liberal *Who's Who* in the upper chamber. McGovern has received money twice; so have Philip Hart, William Fulbright, Clifford Case, and a few others. Edward Brooke was assisted in 1966, the year he crossed the Senate's color line, and Thomas Eagleton in 1968, four years before he became famous as the vice-president who never was. Alabama's John Sparkman, no liberal on most domestic issues, was given $2500 in 1966 to help fend off a challenge by an archconservative Republican. While the council cannot flatly claim credit for the victories of these or other candidates, its officials believe that council funds made the difference in several of them—Frank Moss and Gale McGee in 1964, Mark Hatfield and Lee Metcalf in 1966, perhaps Fulbright in the Democratic primary in 1968. (Wyoming's McGee has become an embarrasment to the council—"an outrageous hawk on the war," as one official puts it.)

In the 1972 campaigns the council supported more than a half-dozen first-time candidates for the Senate: Joseph Biden in Delaware, William Hathaway in Maine, Dick Clark in Iowa, Floyd Haskell in Colorado, William Davis in Idaho, David Pryor in Arkansas, and James Abourezk in South Dakota. Most of them were newcomers to national politics, and all save Abourezk were considered underdogs. Yet with the exception of Davis and Pryor—who lost in a close primary race against the powerful Sen. John McClellan—all of them won. So did two council-aided incumbents who encountered stiff opposition: Montana's Metcalf and Claiborne Pell of Rhode Island. Contributions to these campaigns generated by the council ranged between $18,000 and $50,000. The totals were not so significant as what they represented as a proportion of individual campaign costs. Of the slightly more than $200,000 spent by Hathaway, for example, $27,000 came via the good offices of the council. Further, in almost every case, money came when it was most needed in an underdog's campaign—early.

"They were a great, great help," says Claiborne Pell of the council-inspired contributions to his campaign, "all the more so because they came in early. That enabled us to plan and make commitments at the outset, when that should be done." The council provided important advice as well: On the recommendation of its staff members, Pell retained television image-maker Charles Guggenheim, whose work became an important factor in the Pell victory.

From time to time, council support has itself been an issue. The opponents of several council-aided candidates have referred darkly to "outside money," and such conservative spokesmen as columnist Holmes Alexander and Spiro Agnew have characterized the group as one that seeks, in Alexander's phrase, to "see America stand naked to her enemies." During the 1964 campaign, several Republican candidates attacked their Democratic opponents for receiving council funds. One of their pieces of ammunition was a report by "a group of Senators and their staffs" alleging that the council's goals included "turning this country into a fourth-rate power at the mercy of the international wolf pack."

In last year's Rhode Island race, Republican John Chafee charged that Pell's acceptance of council support signaled his abandonment of the *Trident* submarine project, an economic sacred cow in the state. (Several thousand Rhode Islanders work on the project at the General Dynamics boatyard in Groton, Connecticut.) Pell rebutted the charge by saying that he favors *Trident* despite the council's opposition to it. The fact that he was able to take such a stand and obtain council support demonstrates the organization's non-dogmatic approach. "It understands the practical problems of being a liberal and staying in office," says Pell's administrative assistant, Paul Goulding.

The council's top men respond with a tolerant chuckle to suggestions that they are amateurs dabbling in the business of getting people elected to statewide office. "There are actually very few pros in politics," says Bernie Feld. "Anyway, after working at this for ten years, I know a little something. We get advice from other people, but we make all the final decisions ourselves on who we're going to support." (The decisions can be puzzling. Last year the council board turned down an appeal from a moderate North Carolina Democrat, Nick Galifianakis, who was staging an uphill fight against an archconservative Republican candidate, Jesse Helms. Galifianakis, the board members felt, wasn't "impressive"—so Helms was left to in effect cancel one of the council's liberal victories.)

Although delighted by last fall's results, council officials anticipate a difficult time in 1974. "The Senate races should be bloody," says William Doering. "Nixon and Agnew will be out raising hell to try to make up for last year's defeats." And the liberal senatorial candidates, newcomers and incumbents, will be looking to a group of academics, a scattering of trusting contributors, and the spirit of Leo Szilard to help them repulse the assault.

Mr. ZABLOCKI. Thank you, Dr. Marcy.

Thank you, gentlemen, for your statements.

With your indulgence we will recess for approximately 5 to 10 minutes to respond to the call for a vote on the House floor.

[Whereas a short recess was taken.]

Mr. ZABLOCKI. The subcommittee will resume the hearings.

Gentlemen, I want to say again that your testimony before the committee has been most helpful. I am sure the question period will bring out some of the details about your positions.

HEARINGS ANTICIPATED ON "FIRST USE"

Let me at the very outset say that all three of our witnesses have addressed themselves to the desirability at some time in the future of a unilateral declaration renouncing the first use of nuclear weapons. I might say that this subcommittee intends to pursue this question based on the resolution introduced by the Congressman from New York, Mr. Richard Ottinger, and others. We hope to hold hearings on that question some time in November.

Likewise, I appreciate the plaudits and the comments about the resolution before us, House Concurrent Resolution 371, but I would be less than honest if I did not give the due credit to my colleague from New York, Congressman Bingham, who was one of the chief sponsors of the resolution.

Now, it appears that there is a difference of opinion among our witnesses. Professors Rathjens and Fisher are more in agreement than disagreement. The only disagreement between you two gentlemen and Dr. Marcy is the scope of House Concurrent Resolution 371. You differ with Dr. Marcy over the language which allows agreement only if other suppliers agree. Those of us who are sponsors of that particular language share some of that concern.

POLITICAL EFFECTS OF RESOLUTION CONSIDERED

In part, Dr. Marcy's defense of that language was that it may make possible decisive support for the resolution rather than marginal support or even possible defeat.

Professor Rathjens and Dean Fisher, what are your opinions on this political consideration of the resolution?

Mr. RATHJENS. Mr. Chairman, I really have to defer to you on that, you and the other members of the subcommittee. My observation about the desirability of not making this part of the resolution contingent on everybody coming aboard is made without reference to any attempt to judge how it would fare in the Congress.

I think I would agree with Mr. Marcy that if it comes to a choice between including that clause and getting a large vote or having the resolution defeated it would be easy for me to agree that the clause had better be included. But I can't count noses.

Mr. ZABLOCKI. Dean Fisher, you have been around and you are a capable judge and observer of Congress. Would you care to comment?

THREE-STAGE PROPOSITION OUTLINED

Mr. FISHER. Mr. Chairman, with the greatest respect I would suggest that it ought to be that in the area where it is the toughest; namely, paragraph 3 in the terms of suppliers, it is much tougher than in the case of the test ban. You might do it in a three-stage proposition. That the United States expresses strong support for its policy and that it apply this policy; that it attempts to get support from other major nuclear suppliers to make this policy viable and it not come off this policy until such time as undercutting by other major suppliers makes this an exercise in futility.

We don't say okay let's do it if the French will say yes. Let us announce we are going to do it and start doing it and continue doing it unless it is apparent that the French undercutting has made this policy no longer viable.

I think a much stronger case can be made for the necessity of this language in paragraph 3 than there can be in paragraph 2 because there you aren't dealing with national security where we are way ahead of them but we are dealing straight from "Who sells reactors to whom" and you have a competitor here.

It seems to me to adopt a three-stage problem, this is what we want to do, we will do it and we will attempt to make it viable and not come off it until it is apparent that French undercutting is cutting the ground from under us. I don't think we have explored whether the French will cooperate in this area or not.

Mr. ZABLOCKI. My view is that it is better to get half a loaf rather than reach for a whole loaf and get nothing.

REVISION OF DEADLINE ADVISABLE?

Mr. Fisher, on the question that you have raised regarding section 3, "the Congress urges a halt on further transfers of nuclear fuel, technology, and equipment to any country which has not accepted International Atomic Energy Agency safeguards on all its nuclear programs or which by January 1976, has not become a party to the Treaty on the Non-Proliferation of Nuclear Weapons if all other major nuclear suppliers agree to a similar halt on such transfers," we do put the priority on vendors complying with safeguards.

If we change the date from January 1976 to 1977 would that meet some of your reservations?

Mr. FISHER. I think it might, Mr. Chairman, but the real problem is sort of like a twin safety in football. Who announces he is going to go first? We say we would like to do it and we propose to do it but we won't do it if we are undercut by the French. You could write it in such a way that Congress expresses support for the policy and not come off it until negotiations with other countries to make this policy doable and not come off it unless we realize we are being seriously undercut by others.

Mr. MARCY. The problem with Dean Fisher is that he is confusing what the Congress should be doing with the actual negotiations that may need to be conducted. I question whether it is feasible to try to put in a resolution which in effect says to the executive branch try this for 6 months or 6 years or some other period of time and if it does not work try something else.

It strikes me that the Congress would be much better off if they could make a rather flatout statement of what it believes it will agree to.

IAEA SAFEGUARDS: PREFERABLE TO NPT MEMBERSHIP

Mr. FISHER. The problem I have with the present draft is that it is a great invitation for the executive branch to say that it will not agree to this, so why do anything rather than push in the direction of adopting a policy.

I thoroughly commend the IAEA safeguards as an alternative to membership in the Non-Proliferation Treaty. That seems to me the only way you can seriously talk to the French. We are talking about the French and South Africans. We are not really talking about Britain. I think if we adopted this policy we could persuade Germany to go along. The Soviets will go along with it. We are really talking about France and South Africa primarily. If we say we will do it only if the other countries agree you give them a built-in excuse for doing nothing. I look at it from a slightly different point of view than Dr. Marcy does in terms of what impact will this have on a person in the executive branch.

I have felt the heat in the past, myself, occasionally even seen the light, more often felt the heat, the nature of the pressure. The current resolution has a built-in excuse for doing nothing in my judgment. That is from a person who has been on the receiving end of this type of resolution in the past.

INTENT OF RESOLUTION: TO INVOKE EXECUTIVE'S REALIZATION OF CONGRESS SINCERITY

Mr. ZABLOCKI. The intent of the sponsors is to set a goal with the hope that the executive branch will realize the sincerity of the congressional expression. Also, we hope the executive branch would apply its good offices to bring pressure on those who will not comply.

Mr. **Lagomarsino.** I have some questions that I would like to address to the panel; whoever wants to answer them can. Then I will probably have some individual questions.

I understand that it was once believed that widespread distribution of nuclear weaponry would actually have a stabilizing effect on world politics, the thought being I guess that you don't attack someone who is armed with a similar weapon and if there are enough people in that category that that would cease to be the kind of threat that it was first perceived to be. Of course, it was argued by some that these nuclear weapons would somehow equalize the states of various sizes and strengths. There are a lot of flaws in that view, of course.

I wonder if, to your knowledge, this view is still held by very many people?

WIDESPREAD NUCLEAR WEAPONRY AS A STABILIZER

Mr. **Fisher.** If I may, Mr. Lagomarsino, there was a very short time that that was almost a panic relation to the initial Soviet blast in 1949. It so surprised everybody because it came a year before people thought it would come. I think most people have gotten over that. We had an experience on this in the European context with the MLF, Multilateral Nuclear Force, but that did not seem to go very far. It more or less sank without a trace, I think.

So, I don't believe the concept of everyone having their own bomb will keep them from being nervous about the Soviet bomb. I think we are past that stage and we are worried about the fact that they might bomb each other and that might get us bombed.

Mr. **Lagomarsino.** Would it be possible to make a distinction between rational and irrational action here? This kind of proliferation might deter the so-called rational action as distinguished from the irrational man gone crazy, or terrorist-type activity.

Mr. **Fisher.** I really don't think so, Mr. Congressman. I think the idea of giving everyone a bomb and we will all be equal, something like the 45 in the opening of the West——

Mr. **Lagomarsino.** Somewhat different.

Mr. **Fisher.** It is quite different. I think the people generally speaking thought that didn't make much sense. There are possibilities of escalation. One can only think of the possibility of involvement of a nuclear device used in the Middle East, in the Sinai. Think of the possible ramifications of that.

MIDDLE EAST: NUCLEAR CAPABILITY

Mr. **Lagomarsino.** Take the Middle East for a moment. There are those who say, without proof I gather, that the Israelis have atomic weapons or certainly have a capability to produce them. The thinking seems to be that the Arabs probably do not. Would it increase or decrease the likelihood of atomic war if the Arabs had whatever capability the Israelis have?

Mr. **Fisher.** I think there are different problems. I think if the Israelis started rattling nuclear weapons around——

Mr. LAGOMARSINO. Which they have not done.

Mr. FISHER [continuing]. Which they have not and this treaty is one of the reasons they have not. The other reason is that there would be Soviet reaction in terms of establishing relationships involving Soviet missiles in that area not dissimilar to certain arrangements that they have with Warsaw Pact countries and we have with NATO countries.

Mr. RATHJENS. May I comment, Congressman?

Mr. LAGOMARSINO. Yes.

STABILITY PROPOSITION NOTED AS FALSE

Mr. RATHJENS. It does seem to me that the first part of the proposition is false. It is not going to improve stability. I remember reading an article many years ago where somebody claimed the magic number was five, five nuclear powers was the best possible number. I never believed it at the time and I don't now.

It seems to me the more you have the worse off you are.

The second part of it I think there contains some truth. It does make the little fellow, probably strengthens his position vis-a-vis the big fellow.

It is a less stable world, I think, when more nations have one, rather than when one nation like the U.S.S.R. and other big nations. We lose twice. We lose because of diminished stability and we lose because our strength becomes weaker relative to others.

Mr. LAGOMARSINO. You might say that for the rational little power that might otherwise in the course of events be gobbled up by a larger power, for them to own an atomic weapon might be to their short-range advantage.

Mr. RATHJENS. It could be, yes, although I would not advocate any of them acquiring it.

Mr. LAGOMARSINO. I am not saying that. I am saying that is a fact. If Israel does have atomic weapons I am sure that is their rational for doing so.

Mr. MARCY. I don't care who has it, the first nuclear weapon which is fired in anger by anyone is going to just raise the devil with our policies and our attitudes, no matter who does it first.

ARGUMENT FOR SMALL NUCLEAR POWER DEVELOPING NUCLEAR WEAPONS

Mr. FISHER. To make one other point, with the possible exception of the concept of the French Force de Frappe, normally the argument for a small nuclear power developing nuclear weapons is not to prevent it from being gobbled up by one of the giants—that no longer is a possibility anyhow because there are other giants around—but let us assume we had an argument in Israel about going nuclear, it would not be to go nuclear to bomb the Soviets or us, it would be to go nuclear to bomb Egypt or Syria.

Mr. LAGOMARSINO. That, as you say, might not be true of West Germany or France. In that case, their neighbors or next-door neighbors are superpowers that might gobble them up.

Mr. FISHER. France presents a special case. That is one of the reasons for my carefully qualified language in Divonne about the "no first use," that I hope the French Army feels that its real security lies in NATO and not with developing an independent nuclear capability which seems to me would result in repercussions in the Soviet Union which would cause us all to head for the bomb shelters.

Mr. LAGOMARSINO. Can you evaluate IAEA procedures for accounting for nuclear materials?

PROLIFERATION WILL CAUSE ENORMOUS BURDEN ON IAEA

Mr. RATHJENS. I don't claim expertise. To the extent that I understand the situation, it is reasonably good but troublesome in the sense that the magnitude of the job is going to increase so rapidly with the proliferation of nuclear power that it would impose on them an enormous burden in expanding their capability.

Again, it is one of these problems that is compounded. They have to be able to handle more reactors all over the world and they probably have also to reduce the uncertainties. You have to improve your procedures simply because of the larger amounts of plutonium.

My reaction is one of reasonable satisfaction now but concern that they can't keep up with this problem. In any case they will require an enormous amount of support to do so.

Mr. LAGOMARSINO. Dean Fisher, you spoke to us to some extent. Do you believe a strong military alliance posture such as NATO can help increase the confidence of individual members and thus diminish their incentives for acquiring nuclear weapons?

Mr. FISHER. I do.

Mr. LAGOMARSINO. One problem with that is that West Germany, if it does not have nuclear weapons certainly has the capability to produce them and France has them. Although France is not a member of NATO it is a kind of cousin.

STRONG ALLIANCE POLICY IS VIABLE ALTERNATIVE

Mr. FISHER. It is a member of the treaty. It is not participating in the skin and bones that make NATO other than a piece of paper.

Mr. LAGOMARSINO. It is participating far more than most Americans think it is.

Mr. FISHER. Yes, that is right. I will confess that may result in an ideological holdover from my second time around in the Government. I worked with Mr. Acheson on the Senate resolution getting troops to Europe and I consider that resolution rather a successful part of U.S. foreign policy. I think we should continue with it, readjust it. What was good in the fifties does not mean it is good in 1975 but nevertheless a strong alliance policy I think is the viable alternative to the pressures in Germany that might want to go nuclear. I think if they went independent in nuclear capability it would be the greatest threat to peace. I listened in Geneva to the Soviets talking about nuclear war in 1970 or 1980 and know their feeling about the Germans and all the references to the 20 million dead. It is easy to dismiss these speeches as a propaganda exercise.

Mr. LAGOMARSINO. Some of us were in Vienna and we attended some of the MBFR talks. We had a chance to talk to the Russian ambassadors. It was very interesting. They made the point several times of their great fear of West Germany. At first I thought this was just propaganda and was a posture, but the more you listened to them the more you felt that, rational or not, it was a real fear with them.

Mr. Fisher. Sir, I referred to the speech and I referred to it when I was in the executive branch. It is easy to dismiss this as propaganda except the 20 million dead were dead.

RESTRAINTS ON QUALITATIVE IMPROVEMENTS

Mr. Lagomarsino. You suggest on page 3 of your statement that the subcommittee might consider adding to the declaration of policy that the Congress call as well for restraints on qualitative improvements to weapons systems.

Are you making that recommendation without regard to what Russia might be willing to do in the same regard?

Mr. Fisher. Oh, no. To some degree, yes, but I think there is a momentum here that we might calm down and not pick up again unless the Soviets indicate they are running away from us on that. I think it ought to be accompanied with the negotiating posture, Mr. Congressman. I have a feeling that mutual restraints in this particular area might be helpful as well. I am not a believer in the view that everything you are negotiating to restrict you have to go ahead and do anyhow in order to make it possible to negotiate. There is an element of truth to that and I once delivered a paper on the fallacies of the bargaining approach. It was almost as doctrinaire as the bargaining chip approach itself, proving everyone takes on the basis of his adversary. It is a question of what is the mix. I think though we probably have had a little too much mix on developing weapons systems so that we can ban them. We did it in the ABM and ended up with a system that we don't want after spending a lot of money. We didn't do it. Some people thought that the MLF was the bargaining chip that made the Non-Proliferation Treaty possible. That was not true. It was not until Congress made it clear that MLF was not going anywhere that the Soviets were interested in negotiating a Non-Proliferation Treaty. I am half and half. It involves a judgment factor and it is awful hard to express that in a short sentence.

Mr. Zablocki. Mr. Bingham.

Mr. Bingham. Thank you, Mr. Chairman.

First I would like to express appreciation to you, Mr. Chairman, for your kind words earlier and to say that you exaggerate my role. You have taken the leadership in this matter.

UNCERTAINTIES EXPRESSED

Mr. Zablocki. It is a fact.

Mr. Bingham. I thank you.

Also, I want to say I don't think any of us are wedded to the precise terms of this resolution. I think we certainly welcome your suggestions with respect to it. It may well be that before we act on it that we will want to refine it or perhaps change it.

I find myself, for example, of an uncertain mind with respect to the matter of putting the conditions on that other nations must comply. I understand the argument that Dr. Marcy makes. Certainly it would be easy on the floor.

On the other hand, I am impressed with Dean Fisher's point that it might be an excuse for the administration to do nothing.

I also would like to thank all three witnesses for most interesting papers. The whole subject is a fascinating one and one which is of the utmost importance. I think Ambassador Moynihan was correct when he said in his view the matter of proliferation was the number one question facing the world today.

CONSIDERATION OF "NO FIRST USE" CONCEPT

First. I would like to discuss the matter of the first-use concept. Although we don't really deal with that in this resolution, perhaps we ought to consider it.

I welcome the statements that have been made particularly by Dean Fisher about the importance of the matter of West Germany and not doing anything that would encourage them to develop nuclear weapons. As you may know, Congressman Ottinger has introduced a resolution calling for no first use and I introduced thereafter a resolution calling for no first strike.

I like the idea of trying to find language that would preserve the situation with respect to the NATO problem, the German problem, and still make the prohibition as broad as possible. You suggested some language, Dean Fisher. I think if you would care to refine that or give us something in writing I personally would very much welcome that.

Dr. Marcy's statement simply says no first use against a nonnuclear state.

That gets to the same point in a rather simple way. However, I don't think that deals with the Secretary of Defense's statements about limited nuclear attacks and so on that we really find extraordinarily worrisome.

So, if you have further thoughts on the matter of how we could word the qualification that would prohibit use except in the limited instance that applies to NATO, I would welcome them.

LANGUAGE TO BE SUBMITTED

Mr. **Fisher**. The term that I used in discussion with other people purely informally was not to be the first to use nuclear arms against a nonnuclear weapon party unless that party is engaged in armed attack in concert with a nuclear weapon power.

I would like to refine that, Congressman Bingham, because this was directed primarily, entirely in the NATO context. I never dreamed that we were thinking of surgical strikes in the Soviet heartland on the theory that that would not lead to automatic holocaust. This formulation of a non-first-use problem was directed to a situation that I thought might be realistic. I did not consider the suggestion made by the Secretary of Defense, I did not think that was a realistic proposition. Maybe it is a good muscle-flexing proposition but nevertheless not even that, the concept that you can have an attack on the

Soviet Union and not expect them to retaliate and say, "Sorry, you taught us a lesson." It does not seem to me to be a realistic policy in this world. This formulation does not cover that.

If the chairman will permit, I will be glad to submit a revised draft of it.[1]

Mr. MARCY. Could I comment on that, Mr. Bingham?

POSSIBLE LANGUAGE EXPLORED

I think you could say something on that subject in this resolution and let me try this on you.

> That Congress will support an agreement by all nuclear weapon states not to use weapons against any non-nuclear weapon state party to the treaty.

That has the qualification that bothers both of my colleagues here. It does not say we won't do it. It says we will support an agreement if you can get that kind of agreement.

It seems to me the more I look at the Soviet Union or other nuclear weapons states that it is perhaps as much in their interest as it is in our interest to tell states that don't have nuclear weapons that that is a great safeguard for you fellows because we are not going to use and we have agreed we are not going to use nuclear weapons against any state that does not have it. That still does not cover your point of a state which is backed up by a nuclear power.

If you are going to use a nuclear weapon the Russians will give a nuclear weapon to a state to use it or we, ourselves, would do that kind of thing. If we could get an agreement by all the nuclear weapons powers not to use their weapons against the nonnuclear states it would be a step forward.

Mr. BINGHAM. Does that meet the problem that we are concerned about with respect to the first-use doctrine?

Mr. FISHER. It does not.

Mr. BINGHAM. Do we have to state it two different ways?

POSSIBILITY OF CONGRESSIONAL CONSULTATION

Mr. FISHER. I think you do, Congressman Bingham. None of us dealing with the problem in the informal negotiating field felt it was necessary to deal with it because that was not a realistic possibility.

One way of doing it, is a resolution requiring that the first use of nuclear weapons is after all a rather important decision and that there be some form of congressional consultation on that similar to a declaration of war. It would be more than a declaration of war. The first use of nuclear weapons now makes a decision which makes Pearl Harbor and the decision with respect to Germany on December 11 relatively insignificant.

Mr. ZABLOCKI. Let me interject, Mr. Bingham. As you know, there have been several resolutions introduced on the first strike question. Important as both issues are, I think we might risk losing the broad support needed for this resolution if we add it to the first strike matter.

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[1] For draft legislation see response to question 2 on p. 61.

FIRST USE ISSUE TO BE FOLLOW UP

Also, we would have to further broaden these hearings to include the sponsors of the various first use resolutions to have their input. We have already assured the sponsors that the resolutions providing for a declaration of no first use will be the followup to this resolution. I think this really should stand on its own, Jack.

Please be assured, however, Dr. Marcy, that your suggestion will certainly be kept in mind when we consider those resolutions. It is a very good suggestion.

Mr. **Marcy.** It does not really meet your point; that is right.

Mr. **Zablocki.** Congressman Bingham has to leave. I wonder if you would be willing for the record to supply the answers to questions that he will provide to each of you.

Mr. **Fisher.** Yes, sir.

[The information follows:]

RESPONSES BY ADRIAN FISHER TO QUESTIONS SUBMITTED BY CONGRESSMAN BINGHAM

Question 1. In terms of unilateral initiatives by the U.S., what was the history of the U.S. suspension of nuclear tests in the atmosphere?

Answer. The U.S. termination of nuclear tests in the atmosphere was a unilateral initiative which depended, however, upon reciprocity. It was announced in President Kennedy's American University speech on June 10, 1963 in which he stated:

First: Chairman Khrushchev, Prime Minister Macmillan, and I have agreed that high-level discussions will shortly begin in Moscow looking toward early agreement on a comprehensive test ban treaty. Our hopes must be tempered with the caution of history, but with our hopes go the hopes of all mankind.

Second: To make clear our good faith and solemn convictions on the matter, I now declare that the United States does not propose to conduct nuclear tests in the atmosphere so long as other states do not do so. We will not be the first to resume. Such a declaration is no substitute for a formal binding treaty, but I hope it will help us achieve one. Nor would such a treaty be a substitute for disarmament, but I hope it will help us achieve it.

Question 2. Should this resolution include a declaration calling for a no-first-use policy against non-nuclear states? How would you word such a paragraph?

Answer. A draft resolution dealing with non-use of nuclear weapons could state the sense of the Congress that the U.S. would not use nuclear weapons against another state except in defense against an attack carried out by, or in concert with, a nuclear power and, even in these circumstances, only after appropriate consultation with Congress.

Question 3. Would you recommend a clause in the resolution calling for strengthening of efforts to persuade other nations to join the IAEA?—to sign the N.P.T.?

Answer. On the subject of strengthening the Non-Proliferation Treaty, I do not think it would be feasible to embargo all nuclear assistance except to parties to the treaty. Substantially the same result might be achieved by the United States, in cooperation with other suppliers, announcing a policy under which nuclear assistance, by any state, whether or not party to the Treaty, in the form of material and technology, should go only to non-nuclear weapons states which have agreed to accept approved IAEA safeguards on all their peaceful nuclear programs.

Mr. **Zablocki.** I would like to pursue the question that was raised by Congressman Lagomarsino on IAEA. All of us have expressed some concern about it.

Adrian Fisher asked rhetorically whether IAEA is worthwhile. You answered that it is worth continuing but it should be improved.

Specifically, on page 7 of your prepared statement, Mr. Fisher, you state "I believe the IAEA does a competent job, within the limitations imposed by its statute and by political realities." Would you care to amplify on the limitations you have in mind?

Then, I would like to ask the panel their views on how the effectiveness of IAEA could be increased.

THE IAEA DESCRIBED AS WHISTLE BLOWER

Mr. FISHER. The IAEA by its statute does not have the police type of authority. It is a whistle blower. It does not have police power. It is under criticism for not giving assistance to other countries to deal with the problems of physical security.

I believe now it is working up things that it can only recommend. It cannot impose, itself. It is a relatively small organization.

I remember when we were negotiating the problem of the relation between Euratom and IAEA; I suddenly realized the monumental problem in deciding on the six inspectors and how IAEA would divide the chore. I think it needs greater financial support.

My only concern is that we don't worst case the IAEA out of business by saying all the things that could probably be done in circumventing the IAEA without recognizing the difficulties of any worst case analysis is one of the worst cases to the alternative and if we didn't have the IAEA and we set up an organization, this, that, and the other, you sort of worst case in both the alternatives. Intellectual candor indicates that you don't worst case either one.

IAEA NEEDS BACKING

I feel that the thing to do is to get behind it and support it, push it, rather than say it is no good, because what are you going to put in its place? Another control organization? Do we start from scratch and negotiate that with the Soviets?

The IAEA is the creation of President Eisenhower, but it didn't have much to do for a long period of time. Now, it has a role, and it seems to me, let us see if it grows with the role.

Mr. RATHJENS. As I indicated earlier, I don't pretend to be a great expert. I am quite pleased with what they have done and the way they are operating. I am concerned about their ability to continue to do the kind of job that they have been doing without increased financial support.

The other question that keeps coming up, though, is whether their role should be expanded. This bears, perhaps, on the last section of your resolution, when one begins to be concerned about multinational organizations and facilities for processing plutonium fuel, also, for that matter, proposals about multinational facilities for uranium enrichment.

The question comes up, if they are to be run on a multinational basis, how do you organize for that?

MULTINATIONAL FACILITIES: PROBLEM OF ORGANIZATION

Some proposals have been made that maybe that problem should be also turned over to IAEA, that they should get into the fuel separation and uranium enrichment business on the part of the world community. That would be a very big load to impose on them.

I suspect there would be a lot of resistance, that that organization couldn't take it. My own view is that, in the long run, maybe not very long either, we are going to have to go in that direction if we are going to have to handle the proliferation problem. Somebody will have to do that.

We will have to have multinational facilities. I think there ought to be a serious exploration as to whether or not IAEA ought to have some role in that, either in an advisory capacity, or possibly even as a manager. That is a big job.

Mr. Zablocki. Mr. Marcy.

Mr. Marcy. I am not competent to talk about IAEA because I know very little about it. I make only one point. Mr. Fisher says, in his statement, on page 7, IAEA has no enforcement powers.

GIVING MUSCLE TO IAEA

Agreed. One of the things your resolution does in paragraph 4 is to provide some muscle to IAEA, not by legislation but by saying, in effect, to other states that unless they are willing to accept whatever limited kind of thing IAEA can do they sure can't count on getting any help from fuel suppliers. So, it does indirectly try to move in the direction of giving IAEA some muscle.

It is not enough, but it is in the right direction.

Mr. Fisher. Mr. Chairman, if I could supplement my remarks one way.

Originally, the relations between IAEA and Euratom were a stumbling block to this treaty. A modus vivendi was worked out under which we violated every rule in the book and had a treaty that was an agreement to agreee and with some statements that it was possible to have a relative division of roles between the IAEA and a multilateral organization, one that the Soviets did not like at all, which was Euratom. On the other hand, they accepted it.

I think that the very same stone that the builders rejected, so to speak, can be useful here because we do have a model in the relationships between IAEA and Euratom.

EXAMPLE CITED AS MODEL FOR FUEL CENTERS

They worked out an agreement under which you have sort of a relationship between the multinational auditors being sort of like a corporate accounting department and IAEA being like the CPA. That has proved to be, as far as I can tell, not a bad model, even though it was a model that many of us, who were perhaps excessively eager to negotiate the Non-Proliferation Treaty, thought was awful. Euratom would go away, not really because we knew it wasn't but it was a model of a regional organization that has a sort of a regional fuel cycle existing now and it has a relationship to the IAEA.

It occurred to me that that model might be useful in other multinational fuel cycle organizations.

Mr. ZABLOCKI. A very good suggestion.

Before I ask the next question, I would like to ask whether you gentlemen have a copy of the Senate resolution? I would like to ask for your comment on section 5 of Senate Concurrent Resolution 69.

Earlier witnesses recommended that we consider section 5, which provides that the Congress of the United States urges a halt in the production of weapons grade material for weapons used under an adequate verification system and following implementation of this provision that Congress further urges, in order to share American peaceful nuclear resources—that word peaceful would be probably an amendment, because they don't spell out the resources, but it is intended American peaceful nuclear resources—and to quarantee nuclear fuel as needed to satisfy the legitimate energy needs of participating countries.

Now, I take it there was some expression here that even peaceful nuclear energy should be curtailed, if not discontinued. Thereby, I would welcome your views on section 5 of the Senate resolution.

SECTION 5 OF SENATE RESOLUTION ENDORSED

Mr. RATHJENS. Mr. Chairman, I guess I can favor everything that I read there. It seems to me that it is entirely reasonable. I believe that it is of the utmost importance that the legitimate needs of other nations that are determined to use nuclear power be met.

Presently, as you are aware, I am sure, some of the Western European countries are turning to the Soviet Union for enrichment of their uranium because we can't provide it. We can't guarantee it. They either have to go that way, or they have to, in their own self-interest, develop their own enrichment capacity.

I think it is of great importance, if we are to deal with the nonproliferation problem, that those needs be met without driving other countries into building their own enrichment plants.

I would favor this sort of proposal.

Mr. ZABLOCKI. You see no concern with including the verification on which you raised some points whether it was necessary or not?

Mr. RATHJENS. I think, in this case—again, this is more of a job for the IAEA, if you have multinational facilities for enrichment, but they are the obvious agency to do that. I think that kind of verification is very important.

DISTINCTION MADE BETWEEN VERIFICATION PROCEDURES

Let me take a moment to distinguish it. The reason I am not so concerned with verification with respect to the Soviet Union is because they can tell us a hundred times over now what they have, and it does not seem to me it makes much difference if they were to increase their stockpile of weapons by another 20 percent. I would not care much about that, but I would care immensely, just to pick a country at random. I would be concerned if Uganda acquired a nuclear weapon.

I could name a lot of other countries I would be concerned about too. I do think we want to have a kind of verification procedure for handling the world's nuclear industry to make sure that sort of thing doesn't happen.

Then, 10 more kilotons for the Soviet Union will not make the slightest difference to our security. Ten more kilotons to other countries could make an enormous difference.

Mr. FISHER. Mr. Chairman, I would support this. The adequate verification system here really being the U.S.-adopted position set forth in Geneva that we were prepared on the so-called cutoff—is that jargon. I don't know if it is in the SALT lexicon or not—they would inspect on a declared plant basis on the ground that our national verification structure was such as to be concerned about undeclared plants.

The first sentence is merely the cutoff, which, I think, we should have proposed a long time ago and should have pressed.

Now, the second, it seems to me, is really living up to our obligations under article IV of the Non-Proliferation Treaty. I have two quite different views.

I think article V, on peaceful nuclear explosions, means "When, as, and if we ever get around to doing it for ourselves, we will do it for you." That not only has the difficulty that maybe the "if" becomes a "when" and the "when" becomes a "now" in many people's minds.

REGIONAL FUEL CYCLE: MOST ECONOMICAL WAY

With article IV, I think we have long since passed the stage that we can tell other countries "the nuclear age is not for you." The only way we can do it is to live up to our obligations under article IV with a good safeguarding system.

The regional fuel cycle should be supported not on the ground we don't trust you fellows, but on the ground that this is the most economic way to do it. Here, it happens that policy and economics go together. The most economical way to do it is also a safeguard problem, which we have a right to insist on because article IV does not say to do it without safeguards. The two happen to go together, and that is good.

I think we cannot, without tearing up this whole treaty, say we have changed our mind on peaceful use of nuclear energy as opposed to the explosion—we will try to walk the catwalk—we say "We have changed our mind, fellows; it is not for you," and they say "The heck with the treaty, we are going ahead."

They are all the problems of what I referred to as the French syndrome, Mr. Chairman. What we have now would be minor compared to that, if we were to say "forget about article IV; it is not for you, just for us."

DISPOSAL OF MATERIALS IN EXISTING WARHEADS

Mr. MARCY. Mr. Chairman, the only comment I would like to make is that, I think it should refer to urges an agreement to halt. It is just a drafting change. I support it otherwise.

It does suggest to me perhaps, however, that we ought to be thinking not only about a halt in the production of weapon grade material, but we ought to be thinking about what we do with the weapon material which now exists in such vast oversupply in the weapons themselves.

You might want to see if you can't improve on Mr. Cranston's language by suggesting that at least we begin to talk with the Russians, who also have more weapons than they need to do us in, how we go about—and I am not technically competent to go into this question, but how we go about disposing of these materials which are in existing warheads.

I think some thought has been given to that in the United States. It might not be a bad idea to talk with the Russians about how we do this. We ought to be able to cooperate in defusing if we cannot cooperate in fusing the stuff in the first place.

THE WORD "TECHNOLOGY" COULD POSE PROBLEMS

Mr. RATHJENS. Mr. Chairman, let me make one other observation about this.

I am reminded, by the reference to technology, there is a point that is a little bit troublesome about the language, I think, and that is, that some of the kinds of reactors that are presently being developed and that look promising, use essentially weapons grade materials as reactor fuel. Again, I don't think you can argue very persuasively that those kinds of reactor technologies should be stopped.

It argues more strongly for control, careful verification of what is going on in the enrichment process.

Mr. ZABLOCKI. Mr. Lagomarsino.

Mr. LAGOMARSINO. Will one of your gentlemen explain to me the make up and control of the IAEA?

THE IAEA: ITS COMPOSITION AND CONTROL

Mr. FISHER. I doubt if I can. It is not quite, but almost a specialized agency of the U.N. It has about a hundred countries. It has basically two groups. It has a general sort of equivalent of the U.N.—equivalent of a security council.

They are not the same. It is a steering group.

Mr. LAGOMARSINO. It is a separate organization?

Mr. FISHER. Separate organization—it is not technically an agency of the U.N., but it reports to the same committee to the U.N. and has liaison with it. It is like any other international organization; it has two groups of people.

It has U.S. representatives to it. I take it Dr. Tape is the U.S. representative now. Dr. Smyth, author of the "Smyth Report," was for a long period of time.

Primarily, because it got its organizational structure started when there was not much international tension, it worked out arrangements under which the voting arrangements had no veto, but it has no police power.

It originally was set up to do two things. It was set up to dispense assistance to itself in the peaceful uses of atomic energy as a safeguard device for other countries who wanted to give assistance but wanted to be sure they were safeguarded.

Mr. LAGOMARSINO. Was IAEA created before the Non-Proliferation Treaty?

CREATION OF "ATOMS FOR PEACE" SPEECH

Mr. FISHER. Yes, it was created in the fifties as a result of a speech made by President Eisenhower, entitled "Atoms for Peace."

I forgot who the first representative was to it. It was also rare in international organization in that it had an American for one period as chief executive officer. He and Dave Morse were the only two that ever had that job. I think a Swede has it now.

Like any international organization, it has national representatives to it and, then, an international staff. It was created before the Non-Proliferation Treaty. It was created during the Eisenhower administration.

It was a little bit all dressed up, with not much of any place to go. It had both the advantages and disadvantages of that.

Its organizational structure had jelled at a period when the cold war was still going on. When the Soviets were talking troika in the test ban, they agreed to unify the executive here. The disadvantage of an organization that got started with not much to do, it is like the Air Force in the Second World War. The second lieutenants, in 1940, became the boy colonels of 1941. Sometimes that is good and sometimes that is bad.

An organization that gets born when no one cares much about it gets good working relationships. You have pluses and minuses that develop.

PLUSES AND MINUSES DEVELOP IN ORGANIZATION

By and large my feeling about it has been—and maybe this is due to my friendship with Dr. Smyth, when I was negotiating the Non-Proliferation Treaty and the problem of the role of IAEA was called up—we have a great advantage in the United States.

We only say we have disadvantages when we negotiate with the Soviets. We have certain advantages. Lateral communication is much easier.

Dr. Smyth used to come up to Geneva. We would sit around and talk about it. My Soviet opposite number did not have quite the same freedom to call up their man, "Will you fly to Geneva? We want to talk this thing over."

As a nontechnician, I always felt the thing to do was to get behind it and support it with the recognition of many of its theoretical weaknesses; particularly, no police power is a weakness that any international organization, any verification organization, will have. It is the only one that the Soviets have really agreed to.

The Soviets, on the whole, like mutual inspection—"We watch you, you watch us." This one is a bona fide multinational—they have agreed to it. It is not perfect, but my own feeling is——

Mr. LAGOMARSINO. Do the Soviets allow IAEA to inspect their facilities?

IAEA PROHIBITED FROM INSPECTIONS IN SOVIET UNION

Mr. FISHER. They do not. However, we had a very strange analog here for reversal of roles. In the final negotiation of the Non-

Proliferation Treaty, when we were seeking a safeguards agreement, article III, that would permit IAEA-Euratom agreement, the Soviets were demanding, they wouldn't let the IAEA in the Soviet Union because they said:

> It does not relate to the Treaty; we are a weapons' power. Why do you want to come to look at our peaceful facilities, to see that they are not diverted to weapons when we are making weapons?

We tried to get them to do it, but we did not succeed. It is not generally recognized that on any Soviet assistance to the countries in the Warsaw Pact they have agreed it has to be subject to IAEA inspection.

In other words, the Soviets agreed to international inspection of the way they assist the Czechs, Hungarians, Poles, and others. That is the first time—if one may use an obsolete cold war term—that the Iron Curtain was pushed back to the Russian border as far as the freedom of the IAEA inspectors is concerned.

Mr. LAGOMARSINO. They are doing that?

Mr. FISHER. Yes. We were sort of saying, "Well, let us be reasonable." The Soviets were saying "ironclad inspections." You would think it was the test ban negotiations 5 years earlier, except the sides had changed.

REVERSAL OF ROLES SEEN

We were saying, you know, we inspect the reactors on a reasonable basis. The Soviets were saying, how can you have allies inspecting allies.

We were insisting on automatic inspections. It is interesting to see the reversal of roles, but they agreed to it as far as the satellites are concerned. They have not agreed to it in the Soviet Union.

Mr. LAGOMARSINO. Have we agreed to?

Mr. FISHER. In the context of this treaty, primarily, for German purposes, we have agreed that the IAEA look at our peaceful plants. The reason for that is this: I will never forget discussing this with the Germans in 1968.

They said,

> You know, we are not really worried about Semonovitch getting a competitive advantage on it, but we might be worried about Smith, or for that matter, even Smyth.

They were saying,

> We don't want the IAEA looking around at German plants when not looking at our competitors.

President Johnson took the position with the agreement of the nuclear industry that we would on a voluntary basis let the IAEA inspectors come in.

I don't know, since I have been out of Government some time, how well that has worked. I think you might get that from the Arms Control people.

There was screaming by the Soviets that we were getting an advantage on them. They did not want to pay for their share of the inspectors, even though they were inspecting us.

SOVIETS DESIRED TO AVOID SHADES OF THE NYE COMMITTEE

The nuclear industry may have had mixed minds about it. One of the reasons they didn't object to it at the time, whether they had second thoughts I do not know, was that they wanted to avoid—shades of the Nye committee—being labeled "merchants of death." They wanted to be in a position where they didn't have the same problems, basically of image, that many munitions manufacturers had in the early thirties. I had not quite got into law school at that point.

I remember reading about the Nye committee investigations and the whole concept of the chemical industry being the merchants of death and du Pont and everything. I think, du Pont, themselves, are sensitive to that. They wanted to say,

> Look, we are in the business of selling reactors. We don't want people saying we are merchants of death.

Whether they have second thoughts on that, I have not been that close to it for 6 years. I would urge you to see how that is working from people in the administration.

I thought it was a good idea at the time, even though we didn't get a reciprocal Soviet commitment. I tried it. We had a meeting after Glassboro, when the Soviet Foreign Minister was here.

INSPECTION ATTEMPTS PROVED UNSUCCESSFUL

Dean Rusk and I went up and met with the Soviet Foreign Minister, I guess it was Malik, and we kept urging them to permit peaceful inspection of all peaceful reactors in all countries, including nuclear weapons countries.

The meeting was not successful. The reason it was not, whenever it got that way, sort of like a rugby game, Dean Rusk would throw the ball to me. I would say,

> We are not afraid of this inspection, our allies don't want us to get a competitive advantage over them. We are prepared to accept it. What is wrong with you.

So, the Soviet Foreign Minister would say,

> What happens if the inspector comes to a peaceful plant and demands ingress? We say "no, it is a weapons plant." That is silly.

At that stage of the game, Mr. Rusk asked me to throw the ball back to him, and he, being the Secretary, obviously succeeded. We finally decided to make this compromise approach.

I would suggest that you find from someone more au courant than I am how it is working. I submit it is a good idea, since it was mine, but it may turn out to be a horrible idea.

Mr. LAGOMARSINO. One final question.

There is nothing in the organization that would cause you to have qualms about how it might be used against our best interests?

CHECKS AND BALANCES SYSTEM SEEN AS SUFFICIENT

Mr. FISHER. I think it has enough checks and balances in it. Sure, there is some danger in there. The Soviet interest and our interest in the Non-Proliferation Treaty are not that far apart. You have those problems in any international organization.

That will be true when you have any form of multinational organization. I don't think it affects our best interests. I think we have good representatives there, who, if they think that is happening, will let us know.

Mr. **Lagomarsino**. That is something we might want to look into in regard to the troubles in the U.N.

Mr. **Fisher**. Again, I would rather get this from the Science Advisors Office in the State Department. This has not been a particularly forensic operation. If I were to be critical of it, I think it did issue a staff paper—maybe it was an agreed paper—about how they could help in the peaceful nuclear explosions. I felt it was a little bit too enthusiastic in terms of the reality of nonproliferation.

They were saying, can you help in peaceful nuclear explosions. They said "Of course this is what we can do," acting very much like the U.S. laboratories have done when put the same question. This is a technical problem we can solve. Certainly we can.

My own feeling, sir—and this is intuitive, impressionistic—that this is still a going concern. I am sure there is some demagoguery in there; there is in all international organizations.

But the batting average here is pretty good in terms of substance.

REVIEW PERIOD RECOMMENDED

Mr. **Lagomarsino**. You say that you would like to consider striking the words "if all other nuclear weapons states will enter into such an agreement," talking about the comprehensive test ban part of this resolution?

Mr. **Fisher**. Yes, sir.

Mr. **Lagomarsino**. Then you go on to point out on the next page the Soviet Union has already taken the position they are not going to do that unless all other nations join in.

Mr. **Fisher**. Maybe they will; maybe this is part of their cold war against the Chinese.

My recommendation is for a review period after a set period of time. If the Soviets won't play, they won't play.

Mr. **Lagomarsino**. You propose it if they will?

Mr. **Fisher**. Yes. I do not think we ought to have a unilateral moratorium on all nuclear tests if the Soviets won't agree.

Mr. **Lagomarsino**. We will do it if you will do it and if everybody will do it eventually?

Mr. **Fisher**. Yes. That is what we did with the nuclear test ban.

INFORMAL CONVERSATIONS WITH SOVIETS RECEIVE MIXED SIGNALS

Mr. **Rathjens**. I think, in that respect, in informal conversations with them, you get mixed signals on this. I would think that the possibility of their entering in an agreement did not include China but with a 5-year review clause, it can't be excluded on the basis of what we know now.

They might do it; they might not. I think we ought to try.

Mr. **Lagomarsino.** I think, at this moment, they are more concerned about China than us in this area.

Mr. **Rathjens.** They know also they could forgo testing for 5 years and the Chinese would still have a long way to go to catch up.

Mr. **Lagomarsino.** I would be interested in your feelings.

You know, last year we had the proposal, short lived, as it turned out, to transfer a nuclear facility to Egypt and Israel. I say short lived, I don't know what the prospects are now, but it seems to have died out here.

Is it your feeling that we should not sell reactors to Egypt and Israel, even if we could get quite stringent conditions regardless of the fact that they might be able to buy those from some other source?

Mr. **Fisher.** I don't think they are. Maybe they could from France.

My feeling right now is that the safeguards we are talking about are safeguards on that one, on the stuff we supply, not on the rest.

INDIGENOUS FACILITY FOR EGYPT SEEN AS POSSIBILITY

Mr. **Lagomarsino.** What do you mean, not on the rest?

Mr. **Fisher.** Well, they have an indigenous nuclear—in Israel you could put an easy name to it, Dimonq. In the case of Egypt, they probably wouldn't have any indigenous facility, but they would build up a nuclear capability by which they could get an indigenous facility and go nuclear completely within the agreement.

That is what the Indians did.

I felt we ought to try to work a policy which your resolution says, of not supplying things to people who ultimately don't take IAEA safeguards across the board.

Now, it is probably true, if we made that offer to Israel, Israel would probably tell us no dice.

If we made that offer to the UAR, they would probably, I think, accept.

Mr. **Rathjens.** Contingent on Israel accepting?

Mr. **Fisher.** Yes.

Mr. **Lagomarsino.** They might accept it anyway.

Mr. **Fisher.** They might.

AVOIDING THE CANADIAN-INDIAN SYNDROME

Our general approach is such that we ought to be willing to help people out but avoid the Canadian-Indian syndrome, so to speak, and require, to the extent we have not committed ourselves already to do something different, that the totality of the program be under safeguards, not just on the stuff that we give them.

Mr. **Lagomarsino.** I would agree with that. I don't think I would go with the first part, necessarily.

We can make an agreement today with President Sadat; who knows who is going to replace him tomorrow?

Mr. **Fisher.** That is true. That is true even if they were parties to the treaty, sir. There it is a considered risk we took, given a nonproliferation objective. OK, under nuclear safeguard we will help you out.

If we took the opposite position saying that we won't help you out, the nuclear age is not for you, we won't trust you, then, I think we would not have gotten as far as we have gone.

Mr. **Rathjens.** I suspect this is an area where maybe Adrian Fisher and I disagree slightly.

My feeling is that it is reasonable enough to provide them reactors with safeguards and everything, but I have great reservations about providing them with fuel separation plants or enrichment plants even if they have had safeguards because of seizure at a later date.

ADVANTAGES OF MULTINATIONAL FACILITIES ARE TWOFOLD

Mr. **Fisher.** I don't really disagree with George. You could take a position under article IV you don't have to do things that are silly. By and large, the whole concept of those areas of the multinational facility makes sense. It makes sense as a matter of economics, as well as a matter of effective safeguard.

It seems to me one of the reasons I continue to stand and cheer about the purport of this resolution is your last article does that. It points in that direction, and I think it is right.

Mr. **Lagomarsino.** I guess we could go all day.

Mr. **Zablocki.** We have certainly taken a lot of time. I do have one final question.

Professor Rathjens, you had concern about the provision of section 1 regarding the 20-percent reduction, verifiable. You stated that since the Soviets have an overkill, a 20-percent reduction would be meaningless since it would soon be overtaken by improved accuracy and other technical improvements. Can both of you speculate on what the Soviet response might be to a proposed 20-percent reduction, or even a more advanced, 20-percent reduction per year?

Mr. **Rathjens.** How would they react?

Mr. **Zablocki.** How would they react?

SOVIET REACTION TO 20-PERCENT REDUCTION COULD RESULT IN COMPLICATIONS

Mr. **Rathjens.** It is nothing more than speculation. My guess is that they would say yes, in principle it is a good idea, but that one would run into enormous complications. Twenty percent of what? They would argue, well, we want to take the 20 percent in SS–6's, if they had them. They don't. We would say no, we want the 20 percent to include some of your modern missiles. I would anticipate that though they would probably agree in principle it is a good idea, we would have a long, drawn-out negotiation while we attempted to work out details. I sense the fact that there would be enormous resistance really on their part and there would be enormous resistance here, the argument being that after we have invested all of these dollars or all these rubles in the systems, it is an emotionally disturbing thing to throw them away. Even more emotionally bothersome to them than to us because they have probably made greater sacrifices to get them than we have. More of their equipment is newer than in our case.

In principle they would agree and—suspect we would have a hard time.

Mr. FISHER. I don't really disagree with that. You may say why did I favor it if we probably are not going to come up with a result? I would favor your proposal on two grounds. First, there is no harm in trying. If we don't try, we will never know.

RESTRICTIONS ON VLADIVOSTOK: STEP IN THE RIGHT DIRECTION

Second, the weakness of the Vladivostok agreement is that it sets ceilings that are really higher than either of us want to go. I would like to see something to counter the inevitable tendency to have an arms control agreement that really purports to set a ceiling which you have to reach up to get. I remember a cartoonist in ACDA had a cartoon showing three workers at the Ajax Missile Plant, overtime checks coming out of their pockets, saying, "My, isn't it great that the Soviets have accepted our arms control agreement?" You would not want to have that situation unless you had some restriction on Vladivostok which I think in balance I am for.

Unless you have some restrictions, it may be a goal and not a damper. This resolution states that the Congress wants it to be a damper not a goal.

Mr. ZABLOCKI. Under the agreement we would like to see we would not reach the ultimate but 20 percent would be a start in that area where there might be an attempt to fulfill. We would hope they would do likewise. Therefore, there would not be an expenditure or waste of rubles or dollars on our parts on equipment and material that is not yet in production.

Mr. RATHJENS. We would save money, of course, by getting rid of 20 percent. So would they. It is true on both sides. Yet, there is the reaction, I think, certainly in our Military Establishment, I suspect in theirs even more strongly, against getting rid of equipment that is still usable.

Mr. ZABLOCKI. That may be very true. But if both sides are sincere, now we have set a ceiling, if we are going to have reductions it makes sense. Should we not pursue it?

DESPITE DISADVANTAGES, PURSUING REDUCTIONS SEEN AS FAVORABLE

Mr. RATHJENS. I would favor pursuing reductions. I am absolutely convinced that you will pay some political price, maybe prices in other ways, during the negotiating process. There will be pressures in this country to acquire new weapons that we don't need so that we can bargain effectively. I expect the same thing will happen there. It is a question, in my view, of weighing the disadvantages to us during the negotiating process against what may come out at the end.

Mr. ZABLOCKI. Taking your argument, would it be preferable that we have the language we have in the resolution of verifiable mutual 20-percent reductions rather than your suggestion of a 20-percent reduction per year? Using your argument they might have a greater concern with a 20-percent reduction per year but they might accept a flat 20-percent reduction, after that we will take another look.

Mr. RATHJENS. I am sure you are right. They would be more likely to take a single 20-percent reduction than 20 percent per year. It is a question of what is the size of the pot of gold at the end of the rainbow. A single 20-percent cut does not look very impressive to me. Maybe not enough of a prize to try for, considering the cost of doing so, whereas if we could set a process in motion that would lead us toward really more drastic cuts than 20 percent——

Mr. Zablocki. How are you suggesting we do that?

Mr. Rathjens. I am not sure that that is worth trying. I would like to see, if we are going to try anything, to simply propose a much larger scale reduction and, as suggested here, one that sets a process in motion that would continue for some time, continuing reductions.

PRECISION OF LANGUAGE CONSIDERED PREFERABLE

Mr. Zablocki. Would you be happier if we did not have a percentum in this but a verifiable mutual substantial reduction?

Mr. Rathjens. I don't think that helps. Two percent would seem very substantial, perhaps, to some of the people in the Pentagon. Twenty percent does not seem very substantial to me. I would prefer precision of language.

Let me make one other remark in this respect. It seems to me that when one talks reduction, one has to have two objectives in mind. You would like the reduction process to proceed at a rate that is at least rapid enough so that there would be minimal incentives to acquire new systems.

Now, people think that you are going to take a 20-percent reduction and that is the end. All the pressure to replace obsolete equipment would continue to operate. If you were to agree that we are starting a reduction process that is going to be a substantial reduction every year for so far in the future as we can see, it seems to me that would pull the rug out from under those who are proposing new weapons and it would happen, to a substantial degree, on both sides.

REDUCTIONS OFFSET BY ACCURACY

One of the things was to reduce the incentives to build new systems and replace them. The other thing, I think, is that for a variety of reasons one at least wants to stay ahead of the game. You don't want things to get worse. With a single 20-percent cut, things will get worse because, as I indicate, accuracy will overtake that so quickly it would be a fraction of the time that was consumed in the negotiating process when the reduction would be offset by improvements in technology.

Mr. Zablocki. Another thing, to get full support for this, if we amended the section to say: "immediate negotiations on a verifiable 20-percent initial reduction in the number," which would imply that this is the first, hopefully followed by others, would you buy it?

Mr. Rathjens. That helps.

Mr. Zablocki. We are getting you by stages.

Mr. Rathjens. Yes.

Mr. Zablocki. Thank you very much.

Mr. Lagomarsino. You may be cutting back on the size of the loaf again.

Mr. Zablocki. I would rather get a part of the loaf rather than no loaf at all.

Mr. LAGOMARSINO. You might also find right away you are going to have a problem with reduction from what? From what is agreed to in Vladivostok or how many we actually have on hand?

PRIORITY LIES IN COMPLETION OF VLADIVOSTOK

Mr. RATHJENS. It is certainly important to get that Vladivostok thing. To my mind, the first priority is to get that agreement finished.

Mr. LAGOMARSINO. I am wondering if you start talking about what happens after that you might not interfere with achieving it. We have plenty of problems with Vladivostok yet.

Mr. RATHJENS. We sure do.

Mr. LAGOMARSINO. We have not even agreed on what Soviet bombers and cruise missiles.

Mr. FISHER. I can't undertake the colloquy on the same basis as George did because you already have me, I support this. The reason I do is that I don't disagree with much of what George says except I think there is already a political price in Vladivostok, itself, and that particularly when the Secretary of Defense is saying we have to spend more money to get up to Vladivostok, that gives me the willies. Since the political price has already been paid in Vladivostok, I think where I differ with George is on a comparison of risk.

Regarding Vladivostok without anything else, I think the Congress ought to go into it to live up to the purposes of the Fountain amendment. I think you ought to avoid paying a political price for Vladivostok, the notion that we have an obligation to go to all the way up to the ceiling, it will require us to spend more money. It just seems to me, in view of the accuracy argument, it might cut away the 20-percent reduction but what about the accuracy argument without the 20-percent reduction? That will go ahead anyhow unless we do something about it.

As a poor negotiator, I speak from a position of weakness. As to this article, I support it. I hope it goes through.

THREATS TO THE UNITED STATES

Mr. ZABLOCKI. I know we are prevailing on your time. If I may ask one further question because this is of personal interest to me. I am always interested in why certain things happen.

Having such distinguished witnesses this morning, I want the benefit of your views and maybe you can supply the answer for me. Particularly, Professor Rathjens, on page 2 of your prepared statement, you cite three threats faced by the United States. You say that the United States has given almost complete attention to the first; that is, the threat from a possible Soviet attack. However, you say we have virtually ignored the other two threats. Can you state why we have ignore them; that is, the threat of accidents and miscalculations and the threat of nuclear proliferation?

THREAT OF PROLIFERATION MOST PERILOUS

Mr. RATHJENS. Mr. Chairman, this escaped me for at least 10 years. I have been of the opinion that the proliferation threat was relatively more serious than I think most of the people in the executive branch.

In a sense they were right and I was wrong. It has gone much more slowly than I would have predicted a dozen years ago. I would have been quite prepared a dozen years ago to bet that by this time there would probably be not 6 nuclear powers, but maybe 8 or 10, so that on the record, people who thought proliferation was not serious have been more right than I was and I may have overstated it in the past, but I continue to believe it is a very serious thing.[1]

I cannot, I am afraid, do very well in answering your question. I just believe it to be a fact. If I look at the Secretary of Defense's annual posture statement, it is rare indeed where you can find half a page dealing with the proliferation problem. There will be hundreds of pages about "we need this to counter this that the Soviet Union is doing," this and the other thing. Very little about the likelihood of miscalculation and accident. All the emphasis in the Defense Department is that if they are doing this we have to counter this and almost no reference to what is happening in the rest of the world.

It is a fact, but I can't explain it.

Mr. ZABLOCKI. We are hopeful that these hearings will arouse the concern of the public and certainly the executive branch and Congress on the other two dangers.

Mr. RATHJENS. I think it is one of the most constructive things I have seen happen.

Mr. ZABLOCKI. Any further questions?

Mr. LAGOMARSINO. No. I would like to make an observation.

DOD'S POSITION SUPPORTED

With respect to the last colloquy, it is a natural thing for the Defense Department, which is primarily concerned with defense and preparations for war, to be concerned about the nation most likely to initiate that kind of activity. Really, probably from a Defense Department standpoint, there isn't much that they are going to do or request in relation to an atomic bomb owned by India, for example, so I understand how that comes about. That does not mean that they shouldn't and we shouldn't, especially we shouldn't, be concerned about the proliferation. I can see where the Defense Department might set the priorities it does.

I think we should be critical of them if they did not.

Mr. RATHJENS. I agree with that. It does seem to me, as a specific example, that when the Secretary of Defense is pushing this new doctrine of selective counterforce, greater accuracy and that sort of thing, that that could have very pernicious effects so far as the proliferation question is concerned, as I tried to make clear in my testimony. I would at least like to have seen some discussion, some consideration in Defense Department thinking of where the tradeoffs are.

NATO'S ROLE IN PREVENTING PROLIFERATION

Mr. LAGOMARSINO. We are back where we were a half hour or so talking about NATO where he was saying this would be very helpful in trying to prevent proliferation in West Germany, Belgium, and so on.

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[1] For a further development of this question see statement of Dr. Jerome D. Frank on p. 259.

I think that the West Germans are going to be much more secure, feel much more secure if they knew that we would, perhaps on a very selective basis, use a very accurate tactical weapon to save them and save the rest of Western Europe than if they thought that the only way that that would happen would be all out nuclear war, which, of course, could result.

Mr. FISHER. Of course, part of my observation related to strategic weapons. I have my fingers crossed on how we could get away with tactical but I don't think we could get away with strategic.

Mr. LAGOMARSINO. There is also the old adage, you don't always tell everybody what you are going to do. Just like Israel, they are doing fine.

Mr. ZABLOCKI. I can't resist making this comment. As you know, this subcommittee and the Congress have tried to upgrade ACDA via the legislation requiring an impact statement on the part of the Defense Department. Would you agree that this may prompt them to look at some of the other ramifications of some of their programs, considerations, if they have to put in an impact statement, of how these new military programs will affect our arms control and disarmament policy and negotiation efforts?

HOUSE ACDA BILL SEEN AS CONSTRUCTIVE LEGISLATION

Mr. RATHJENS. I applaud that. I think that is a very constructive thing. I have no reservation at all.

Mr. FISHER. I agree with that. I think the House bill is great. At the risk of being presumptious, I have a few qualifications about the bill put on the floor in the other body. I think the House bill is really great. I think it is a very constructive piece of legislation.

Mr. ZABLOCKI. Would you care to identify the weakness specifically? This is outside the purview of this hearing, but if we could have the benefit of your views.

Mr. FISHER. On two areas. One is that it specifies nuclear weapons without any money limitation in the Senate version, which means ACDA is going to get snowed. Second, any nonnuclear thing, it requires agreement, the other side has to agree before they even give ACDA the information. Those are the two primary considerations.

The House bill, on the other hand, has an automatic threshold which, I think, is good. It has a right for the ACDA to ask for information for the sentinel-type programs. I think it adequately preserves the role of ACDA by including NSC in the mechanisms so that you avoid what is referred to as the GAO syndrome. I think the House bill is just about right, Mr. Chairman. It may well be that there are more compromises in this than you felt you had to do, but I think to protect ACDA, putting myself back in the position I was in 7 years ago, I think it came out just about on the button.

The Senate bill, which was an amendment made on the floor, was not terribly well considered. It seems to me it gives the ACDA Director much more than he needs in the area where he doesn't need it, not as much in the area where he does need it. That is the way it seems to me.

FINAL VERSION NOT CONSIDERED COMPROMISE

Mr. ZABLOCKI. I know of your continuing interest and your advice in this field to this subcommittee. Certainly our version that passed in the House was a compromise with the executive branch. I would not say the other body has gutted the legislation, but it came very close to doing it. You would not label the Senate version, therefore, a compromise.

Mr. FISHER. I would not. I think you have already made your compromise, Mr. Chairman. I think it would be inadvisable to compromise on a compromise.

Mr. ZABLOCKI. You would not advise that we lay down and play dead?

Mr. FISHER. No. I think you have a good bill. I advise you to fight for it. I am offering to hold your coat, Mr. Chairman.

Mr. ZABLOCKI. You will also have to hold my glasses.

Mr. FISHER. I think it is great.

Mr. ZABLOCKI. Gentlemen, thank you. I think it was a very profitable morning. I want to thank you sincerely for the time you have given us.

This hearing is adjourned until 2 Tuesday afternoon, October 28, when our witnesses will be Dr. Theodore Taylor, an expert on the question of nuclear theft and terrorism, and Mr. Stephan Minikes, Senior Vice President of the Export-Import Bank, and Dr. Arthur Laffer of the University of Chicago, both of whom will explore some of the economic aspects of the nuclear proliferation problem.

[Whereupon, at 1:05 p.m. the subcommittee adjourned, to reconvene at 2 p.m. Tuesday, October 28, 1975.]

NUCLEAR PROLIFERATION: FUTURE U.S. FOREIGN POLICY IMPLICATIONS

TUESDAY, OCTOBER 28, 1975

House of Representatives,
Committee on International Relations,
Subcommittee on International
Security and Scientific Affairs,
Washington, D.C.

The subcommittee met at 2 p.m. in room H–236, the Capitol, Hon. Clement J. Zablocki (chairman of the subcommittee) presiding.

Mr. Zablocki. The subcommittee will come to order.

We resume this afternoon with the third in our series of hearings on "Nuclear Proliferation: Future U.S. Foreign Policy Implications."

Dictionary definitions of words which we sometimes use too freely are always interesting. "Proliferate" is such a word.

As a verb, Webster says that "proliferate" means "to grow by rapid production of new parts, cells, buds, or offspring." As an adjective, the word is defined as, and I quote, "developing a leafy shoot from a normally terminal organ."

Both these definitions, I think, set the tone of today's hearing. What we are concerned with this afternoon are two different "new parts" or "buds" by which nuclear weapons and technology have spread rapidly.

The first is the question of terrorist threat by theft or diversion of nuclear materials. Our witness, Dr. Theodore Taylor, is a preeminent expert in that area. He has studied the problem exhaustively and written on it widely.

The second so-called offshoot issue involves the economic aspects of nuclear proliferation, the financial lifeblood by which it continues to grow. Here today to discuss that issue is Mr. Stephan Minikes, Senior Vice President of the Export-Import Bank; and Dr. Arthur Laffer, professor of economics at the University of Chicago.

We will hear Dr. Taylor first and see if we have any questions. Then we will hear from Mr. Minikes and Mr. Laffer as a team, if there is no objection.

Dr. Taylor, if you will proceed, please.

STATEMENT OF DR. THEODORE TAYLOR, CHAIRMAN OF THE BOARD, INTERNATIONAL RESEARCH & TECHNOLOGY CORP.

Theodore B. Taylor is chairman of the board of International Research & Technology Corp. (I.R. & T.), a subsidiary of General Research Corp. located in Arlington, Va. Dr. Taylor worked on the design of nuclear explosives at Los Alamos

Scientific Laboratory from 1949 to 1956. In 1956, he joined the General Atomic Division of General Dynamics Corp., where he was technical director of the nuclear space propulsion project (Project Orion) and a senior research adviser. From 1964 to 1966, he served as Deputy Director (Scientific) of the Defense Atomic Support Agency in Washington. He then spent 2 years in Vienna, Austria, as an independent consultant to the U.S. Atomic Energy Commission and several other organizations, working on the subject of international safeguards for nuclear materials. In 1967, he founded I.R. & T., a company primarily concerned with studies of the impact of technology on society. His publications include "Restoration of the Earth" (Harper & Row, 1973, coauthor with Charles C. Humpstone) and "Nuclear Theft: Risks and Safeguards" (Ballinger Co., 1974, coauthor with Mason Willrich). Dr. Taylor graduated from the California Institute of Technology in 1945 and received his Ph. D. in theoretical physics from Cornell University in 1954. In 1965, he was one of the recipients of the Ernest O. Lawrence Memorial Award of the AEC for his work on the development of nuclear explosives and the TRIGA research reactor.

Mr. TAYLOR. Thank you, Mr. Chairman.

I greatly appreciate the opportunity to testify at these hearings on the subject of nuclear proliferation. Although I want to concentrate attention on one particular form of proliferation that has to do with the possibility of nongovernmental organizations, terrorists or whatever, acquiring nuclear weapons, I find it important to keep this in the context of the overall question of nuclear proliferation in general.

PROLIFERATION CLASSIFIED INTO THREE CATEGORIES

I find it useful to distinguish three types of proliferation. The first is what some people call vertical proliferation. This has to do with the superpowers acquiring more weapons or at least changing the character of the weapons.

Second, there is what is often called horizontal proliferation. This has to do with countries that do not now have nuclear weapons, acquiring them.

A third type of proliferation that has gotten very little attention until recently has to do with nongovernmental groups acquiring nuclear weapons.

I find very important interrelationships between these three types of proliferations and actions that ought to be taken by the United States and other countries to help reduce the risk of any of the three or all three.

I doubt that efforts to prevent further horizontal nuclear proliferation among countries will succeed as long as the nuclear weapons states, particularly the United States and the Soviet Union, continue to behave as though they feel more secure with large numbers of nuclear weapons designed especially for offensive use, than without them.

It seems to me this is reflected in House Concurrent Resolution 371's first two declarations with respect to undertaking negotiations to embody agreements under the 1974 Vladivostok Accord and to try to get going on a comprehensive nuclear test ban treaty. But I must say I do not see how successful negotiations would strongly deter any country that is seriously determined to acquire nuclear weapons from doing so. In any case, 80 percent or even 20 percent of the tens of thousands of nuclear warheads now at the ready—still represent potentials for destruction on a scale that I believe must be considered unacceptable.

REAPPRAISAL OF NUCLEAR WEAPONS ADVOCATED

I therefore strongly urge that the United States seriously consider much more drastic measures to reduce our reliance on nuclear weapons, including steps that we might take unilaterally. Specifically, I think we should reappraise the roles of all nuclear weapons we have outside the United States, including those in our submarine fleets, with respect to decreasing the risk of nuclear violence. This assessment should take into account the possibility that U.S. nuclear weapons overseas might be stolen or otherwise controlled by terrorists or military factions of a nation in a state of political upheaval. I find it quite conceivable that we may conclude after doing this that most or even all U.S. nuclear weapons should be withdrawn from foreign soil.

Regarding the third declaration in House Concurrent Resolution 371 concerning requirements for IAEA safeguards on all nuclear programs, I would like to make the following observations. I believe that the world is more secure if any particular nuclear activity is under IAEA safeguards than if it is not. I also can visualize much more effective safeguard measures to detect national diversion of nuclear materials from peaceful to military purposes than are now used by the IAEA, at reasonable costs, and I strongly urge that the United States press for adoption of such measures by that agency.

REMAINING ALERT TO OTHER PERSISTENT DANGERS

However, even if all civil nuclear programs in the world were subject to IAEA safeguards that were highly effective in detecting unauthorized use of nuclear materials or diversion, we should still be alert to other dangers that could persist.

Contrary to rather widespread belief, separation of plutonium from irradiated nuclear fuel—that is, fuel that has been taken out of nuclear powerplants—and its subsequent incorporation into nuclear weapons suitable for military purposes, is not potentially beyond the capability of most countries. A commercially competitive nuclear fuel reprocessing plant that produces separated plutonium and uranium that meets the stringent quality control specifications required by the nuclear industry, is a highly complex, sophisticated facility, costing at least several hundred million dollars. But a reprocessing facility designed only to extract plutonium for nuclear weapons could be much smaller, simpler, and less expensive.

One could describe such a facility in a form that would require only a few months for construction and an operating crew of less than a dozen appropriately skilled people, using information that is widely published and materials and equipment that are commercially available worldwide.

INCORPORATING PLUTONIUM INTO EXPLOSIVES

Subsequent incorporation of the separated plutonium into nuclear explosives requires skills and resources that depend strongly on the desired characteristics of the weapon. Relatively crude, inefficient fission explosives with yields in the range from several hundred to several thousand tons of high explosive could be designed and built conceivably by one person working alone. Militarily useful, more efficient, and reliable weapons in the low-yield range, a few kilotons, could be designed and built by a few appropriately skilled people, using facilities and materials that are available or could be commercially acquired by any country in the world.

All nuclear powerplants now operating or planned make plutonium or uranium-233 from which nuclear explosives can be made. Typical powerplants make enough plutonium in 1 year for at least several dozen nuclear weapons. Consequently, any country having a nuclear powerplant could acquire nuclear weapons if it really wants them. It would have several options, depending on circumstances.

If the country is not a party to the NPT or subject to IAEA or some other safeguards, bilaterally applied, it could make a relatively small reprocessing plant, perhaps secretly, separate the plutonium from spent reactor fuel, and use it to make relatively unsophisticated but militarily effective weapons.

BREACH OF AGREEMENT: SECOND POSSIBILITY

A second possibility is that if the country is a party to the NPT or otherwise subject to safeguards involving other countries it could break its agreements, perhaps having already secretly made a small reprocessing plant and completed all the weapon design and fabrication steps that are possible without actually incorporating plutonium into the weapons. The final steps of separating enough plutonium for several weapons and incorporating it into prefabricated nonnuclear components of the weapons could conceivably be carried out within a few weeks of breaking an agreement.

A third possibility is that if the country has a powerplant that uses recycled plutonium or highly enriched uranium in fresh fuel—that is, fuel to be loaded into its powerplant—it could more easily separate the material before use in the power reactor core than after it has been extracted from the core. Under conceivable circumstances such a country could have several nuclear weapons, at least, within a few days after abrogating a treaty if it had secretly carried out the necessary steps in advance.

These observations lead me to comments on the concept referred to in the fourth declaration in House Concurrent Resolution 371 of heavily protected regional facilities for processing, storage, and fabrication of plutonium subject to strict international safeguards. I understand that this concept is under study by the IAEA but I have not yet seen any of their results.

DANGERS STILL SEEN WITH MULTINATIONAL FACILITIES

Multinational operation of such facilities would clearly make it more difficult for a particular country to divert plutonium from the facilities to the manufacture of its own weapons. Aggregating all of the steps in which plutonium is processed into a relatively small number of large regional fuel cycle support facilities would also make it easier, at less cost, to protect the plutonium in these facilities from theft by terrorists or other criminal organizations.

But the setting up of such regional centers would not necessarily interfere with the three kinds of options for horizontal proliferation I have just described, since plutonium could still be diverted before shipment of irradiated fuel to a regional center or after the arrival of fresh fuel containing recycled plutonium fabricated into fuel at the regional center.

Another aspect of the regional fuel cycle support center concept that must be carefully examined is its overall effect on the risks of theft of plutonium by nongovernmental groups. The risks of theft from the processing, storage, and fabrication facilities would be reduced. But the risks of theft of plutonium in fresh fuel shipments from the regional center to nuclear powerplants in other countries might be greater than if each country processed and fabricated its own plutonium. The reason for this is that shipment routes for plutonium-bearing fresh fuel would be longer generally—this is if they were processed in a central facility—and likely to traverse a number of different countries. These countries might or might not be parties to NPT, might or might not be willing to go along with safeguards.

VULNERABILITY OF THEFT: COULD STILL BE THREAT

Depending on the locations of the regional centers and of the countries they support and on the actual nuclear fuel transport routes that would be used, the overall vulnerability to theft by nongovernmental groups might be decreased or increased. I believe this is a particularly striking example of the complex interrelationship between two different types of potential proliferation.

I believe that the risks of nuclear violence are increasing simply because the forces that drive all three types of nuclear proliferation that I have identified are increasing. Without much more concerted international actions to change the directions of these forces than I now clearly see in prospect, I find it highly likely that nuclear weapons will again be used for destructive purposes before the end of this century. I have no blueprint for a global strategy to reverse these directions. But I am convinced that the key to such a reversal is the creation of an international climate in which it is clear that if any country or group of people uses nuclear energy for destructive purposes, nobody wins and everybody ultimately loses. Nations must find alternatives to the threat of nuclear bombings to maintain their security. To me this means a shift from offensive to defensive military strategies. Without such a shift by the superpowers I see no way to stop other countries from following our example to the point where nuclear arms become traditional parts of all military arsenals, like other weapons. If this happens I find it hard to believe that terrorists and other criminals will not follow suit as they now seem to be doing with respect to conventional arms.

On that not too optimistic note I will try to answer any questions.

HAS NUCLEAR TECHNOLOGY BEEN SIMPLIFIED?

Mr. ZABLOCKI. Thank you, Dr. Taylor. There are some who state that due to the fact that not as many countries have acquired a nuclear capability as was expected 10 years ago that the threat of nuclear proliferation or the dangers of misuse are not as great as some had anticipated. Your presentation takes the opposite view.

Certainly in the early stages when technology was a bit more complex there were fewer nation-states or organizations that could attain nuclear power. But it has been simplified to a point. Is my understanding correct?

Mr. TAYLOR. I wouldn't say so much that it has been simplified as that what needs to be done to make explosives—the information needed to design explosives—has been so widely published for so long that it has become possible for people with training in the basic sciences to use public information to follow a number of much simpler routes to nuclear explosives than had been used in building up these very complicated and sophisticated military weapons systems such as we associate with the United States and the Soviet Union.

Making those types of weapons has not really gotten simpler. But making less efficient, less reliable, heavier weapons is something that always has been possible but has not been of any particular interest to the superpowers.

AVAILABLE MATERIALS AND INFORMATION: DANGEROUS COMBINATION

The nature of the weapons that a terrorist organization or a country that is not designing a 6,000-mile-range ballistic system is going to be quite different from what we and the Soviet Union and the Chinese have been going after.

So I wouldn't say the technology has gotten simpler. I would say the quantities of the materials from which nuclear materials can be made have been increasing but nowhere near as fast as they are going to be increasing in another 2 or 3 years. The materials are available. Information is available. People with training in related technical disciplines are increasing. It is that combination which worries me.

Mr. ZABLOCKI. There are those who say that the delivery capability is something else, that they may have the nuclear capability but do not have delivery capability. Would you care to comment?

Mr. TAYLOR. I think it is a myth that for any country to attack any other country requires anything like the sophisticated long-range missiles that we have. There have been rather detailed studies, the details of which are classified, but of which the overall results, I can say, would lead one to a conviction that any country in the world could attack any other country by means other than long-range bombers or missiles, using clandestine infiltration operations of various kinds. The United States is particularly vulnerable to that. I am not suggesting that it is likely to be a method of attack on the United States by countries like the Soviet Union or China.

NORTH VIETMAM CITED AS EXAMPLE

But I find it conceivable. North Vietnam, for example, at a time when the bombing was particularly intense and particularly if we had escalated the bombing and done what many people in this country were calling for, as General LeMay put it, "bombing them back into the Stone Age," if they reached a point where they thought they had nothing to lose, that they were going to lose unless they did something dramatic and new and if they had nuclear weapons I feel quite sure that they could have gotten a few into the United States and threatened a kind of blackmail which would say, "Get out or we will start setting these off in cities." Given the political climate, the fury that much of this country was in over the war, a very unpopular war, I am not at all sure we wouldn't have just caved in and pulled out.

Mr. Zablocki. Clearly, Dr. Taylor, one of the most effective deterrents to a terrorist threat is a good contingency plan. I realize that information on this subject is sensitive. However to whatever extent you could share some understanding with us it would be appreciated. Further I would appreciate your evaluation of the effectiveness of such contingency plans.

U.S. REACTION TO TERRORIST THREAT

Mr. Taylor. I have to say first of all that I don't know in any detail at all what current plans are by our Government to react to a real terrorist threat. I do know from people that I trust that there has been a great deal of interagency discussion of not just the prospect of nuclear terrorism but the prospect of other forms of what you might call escalated terrorism.

There are an awful lot of ways to do mischief on a large scale, some of which are not nuclear. So far as the problems getting attention in formal gatherings of appropriate representatives of different agencies are concerned, I feel quite sure that there are reaction plans for response now that did not exist 3 or 4 years ago. But as far as the details I don't know where we actually stand.

I do know that 5 years ago I think it is fair to say that no one knew what the contingency plans were or would have argued that they were in any sense adequate. They were quite inadequate.

PAST INCIDENT EXEMPLIFIES RESPONSE TO THREATS

We have an example of how the system operates in the case of a threat which turned out to be a hoax in Orlando. There was a blackmail threat by what turned out to be a high school boy who succeeded in shocking the system rather thoroughly by threatening to blow up a fission-fusion bomb in the middle of Orlando unless provided with a million dollars and a small airplane to get out of the country. The whole thing was a game on the part of the boy.

But what happened in response to that threat made it clear that there was no contingency plan. The inspector who was in charge of this case from the Orlando police force was pretty much on his own. I think it is to the credit of him and that police department that he handled the case in just the right way. He managed it very well. There was no telephone number for the chief of police or someone else in the department to call automatically to get some really expert advice, whether it was a threat that made sense or was something to worry about or not.

I think that has changed. There are telephone numbers now available to police departments to call to get some official help to help analyze the credibility of a threat by appropriate people in the Energy

Research and Development Administration and I also would imagine the Defense Department.

Mr. ZABLOCKI. Dr. Taylor, you state that you feel a nuclear country is safer under IAEA than if it is not. Then you go on to say it is also possible to visualize considerably more effective measures to be taken as to diversion. You further state that IAEA could be effective in a role of preventing a possible terrorist nuclear threat.

Mr. TAYLOR. I think it can in the following way, not directly, because there is no statutory basis now in treaties or in the original statute of the agency that gives it any authority to provide physical security and protection at any facilities under its safeguards.

CONSULTATIVE PANELS PROVIDE RECOMMENDATIONS

Nevertheless the agency has done a lot in this area, I think, by first of all getting together what they call "consultative panels" to address the question of security and come up with a set of recommendations. These are not regulations. They have no statutory basis. But they are recommendations which are put together in what is called "The Gray Book." It was published in June of 1972, I think it was. That book has subsequently been revised. It is now called "The Blue Book." There is a lot of significance in that change. A gray document in the IAEA is one that is not an official IAEA publication. A blue book is.

What happened between June of 1972 and June of last year, 1974 was that the countries that objected to the IAEA paying any attention to this area, let alone making recommendations, were now taking the problem sufficiently seriously, whatever their position on NPT or international safeguards, that they rather enthusiastically supported, from what I can gather, the IAEA making these recommendations. They have no power to implement them. And I think politically it is hard to visualize that they will be given that power. Practically every country that is a member of the IAEA would probably scream at the thought of an international police agency or policing agency exercizing that degree of control which countries reserve.

But I think the recommendations are a big step forward because we have some evidence in other areas of a similar sort, that when recommendations of this sort are put together internationally there is at least a tendency for countries to follow them.

The IAEA has periodically published recommendations, suggestions, on how to handle radioactive materials safely. They have no authority to tell a country to do this or that. But countries by and large, including the United States, have tended to use those recommendations to help develop their own domestic systems.

ADDITIONAL AUTHORITY FOR IAEA NEEDED

Mr. ZABLOCKI. IAEA would play a more important role if it were strengthened. Would you advocate additional authority and in what respect?

Mr. TAYLOR. I would certainly advocate the nature of the safeguarding procedures. It does have a statutory responsibility. There are a lot of technical opportunities for detecting any movement of significant amounts of material from where it is authorized to be to where it is not authorized to be under their safeguard authority or instruments. Some of these have in fact been developed by the United States by the Arms Control and Disarmament Agency particularly. These have been available to the Agency. The Agency has experimented with them but not yet routinely implemented them.

There is a coupling between these kinds of instruments that keep the plutonium and so on under constant surveillance. There is a coupling between those systems and systems that are designed to stop overt acts of theft because the first thing to do if you want to stop a theft is to know what is going on, whether something has been moved to where it is not supposed to be, whether it has been moved to some nonnational enterprise or whether another country is committing the act.

IAEA UTILIZED AS A FORUM

So I think that should be strengthened. I would also strongly urge that the IAEA be used as a forum rather formally for increasing the level of detail of discourse of countries about the nuclear terrorism problem. They can hold meetings aimed at the problem as a whole or various aspects of it. I think that can be done effectively because I find all kinds of evidence that people in countries that have plutonium or highly enriched uranium are very concerned about people stealing material from them in a way that is often not connected at all with their position on the Non-Proliferation Treaty.

I know from statements of Indian officials, for example, that they have taken steps to increase the physical security of their plutonium for reasons that have nothing to do with NPT. Presenting it more strongly, I would say it is hard to imagine any country, any government in power, that has control over these materials that would not be concerned, if they were aware of the concerns, if someone stole the material from them. It is that kind of interest that gives me some optimism that these very complicated political problems—50-odd countries are now planning to have nuclear power—will actually succeed. I think everyday sees that they have got their own situation at the stake and they need to do something about it.

Mr. Zablocki. Thank you.

Mr. Findley.

NUMBER OF COUNTRIES WITH NUCLEAR WEAPONS CAPACITY REMAINS ALARMING

Mr. Findley. Dr. Taylor, on page 3 you say that most countries have the capability of producing nuclear weapons if they have the will and that most can do so in a fairly short period of time with a fairly modest investment of personnel and money. Is that a fair summary?

Mr. Taylor. Yes.

Mr. Findley. "Most countries," would that reach as high as a hundred of them, do you think?

Mr. Taylor. I believe I said "most." And I believe most if not all countries that have power reactors. They need the source material. I still say the hard part of making an efficient bomb is making the plutonium or enriching the uranium in such a way that one has highly enriched uranium.

Mr. FINDLEY. If they have a power reactor and the will to go this route, roughly how much money would a government have to invest to accomplish the goal of building a nuclear weapon?

Mr. TAYLOR. Less than $1 million, if there were reasons why it was important to keep it below that. In fact, so far as the facilities to extract plutonium from spent fuel are concerned, they could cost on a scale of tens of thousands of dollars. I couldn't imagine any nation that would be deterred from doing this because it cost $1 million instead of $10,000.

IAEA IN NEED OF PROMPT CONTINGENCY PLANS

Mr. FINDLEY. Suppose a terrorist group issued a published threat tomorrow. Do you believe the IAEA has a contingency plan which could be promptly fed to the country from which the threat emanated? Would it be effective?

Mr. TAYLOR. I don't believe so. I would bet very strongly that they have no such plan. In fact even though it may have come up for discussion in the agency this is something that is up to each country to work out for itself.

Mr. FINDLEY. You say police departments in this country do have a number they can call for some advice if they get a terrorist threat.

Mr. TAYLOR. I think that is correct. I am not positive.

Mr. FINDLEY. The fact that you are not sure makes me wonder if it exists and if it doesn't we obviously haven't put first things first in dealing with this problem.

Mr. TAYLOR. It is a very fast rapidly changing situation. It is not possible for me to say exactly "Here is what is going on now." But the country is changing rapidly. The character of the safeguards, the character of the safeguard regulations is changing. The industrial response to them is changing. The character of the safeguards applied to materials that are not commercial, on the part of the naval reactor program, for example, or are quite simply U.S. nuclear weapons, is changing. How weapons are handled and retired from stockpile and get replaced by new weapons and so on, and all associated materials are under safeguards, physical security safeguards, the nature of which is changing almost week by week. I certainly applaud that.

REGIONAL FACILITIES CONCEPT: PROS OUTWEIGH CONS

I would think at some point whenever it is appropriate—and I hope it is within the next year—I think there should be an intensive examination by the Congress of just where we stand with respect to the physical security of such materials in the United States, whether they are commercial or noncommercial. Some of those reviews would probably have to be in closed sessions. But I would hope as much as possible could be open.

Mr. FINDLEY. Dr. Taylor, you see both pros and cons to this idea of a regional fuel processing facility. How do you come out at the end, in favor or opposed to it?

Mr. TAYLOR. I think in favor. It is somewhat tentative because I myself have not really looked at maps of the world, if the center were in Switzerland or in Colombia or wherever, to see what would be the transport routes and whether there would be ways of being able to ship a lot of material by sea. There are some things that could be done to reduce the type of exposure and the character of the exposure of material that is being shipped after it has been in process and recycled.

WHAT TO DO WITH FRESH FUEL

One could argue that once the plutonium has been separated and has been incorporated into fresh fuel it should not all go back to all the countries that supplied it. This makes the center an attractive idea to me. One idea which I think is worth exploring is to capitalize on the fact that, for better or for worse, countries have accepted that there are five major nuclear weapon states. I am excluding India. I don't know that they have a nuclear weapons system. But it is possible and might be politically acceptable as a kind of second-best alternative to require that all plutonium that is separated and incorporated into fresh fuel be consumed in one of the five major nuclear weapons states.

That could be called highly discriminatory and so on. I am excluding Japan and West Germany, any but the big five, because they don't yet have large nuclear weapons systems. But if they got fair value in money or enrichment from some other exchange for the plutonium in their irradiated fuel, there is some value which would be attractive to them. I think the troublesome countries, as far as a proposal like this is concerned, would probably be Japan and West Germany particularly because they are certainly not planning to cut themselves off from recycled plutonium because they both have fast breeder reactor programs and a fast breeder reactor system doesn't work unless it has recycled plutonium. So maybe there would have to be somehow a way that would allow them to recycle plutonium. But perhaps most other countries would be quite happy not to have to deal with the stuff as long as they got the energy equivalent or the financial equivalent back. I think that is an opportunity that has some negative aspects but would fit beautifully in a processing and fabrication regional center.

GEOGRAPHICAL LOCATION OF CENTERS POSES PROBLEMS

Mr. FINDLEY. Thank you, Mr. Chairman.

Mr. ZABLOCKI. Mr. Lagomarsino.

Mr. LAGOMARSINO. Dr. Taylor, talking about the regional centers, I gather from what you said that whether you approve the idea might depend on where the regional centers were actually located. Does that mean the actual country, that you would welcome it in some countries more than others? Is that what you mean?

Mr. TAYLOR. I tried to avoid that because I certainly myself have no basis for being able to say that one country is going to be stable for the next 50 years or not. That is a problem with regional centers but not an insuperable one.

I am more concerned not so much with where that country is as with where it is connected geographically with the countries that would be using the facilities for reprocessing the fuel. In my mind that is the question.

Mr. LAGOMARSINO. Your concern isn't centered on the idea that you would have perhaps one regional center where it would be available rather than having it in each of the countries that had it originally.

IMPORTANT TO MINIMIZE NUMBER OF FACILITIES

Mr. TAYLOR. There is a balance there. I am not really sure which way it comes out. I think that a plant will have 20,000 kilograms of plutonium flowing through it per year instead of 1,000 kilograms is unimportant because either figure is quite large and is subject to potential diversion or open theft.

I think the number of such facilities matter much more. The smaller the number of such facilities the better, as far as theft is concerned. So far as protecting the transit of the materials is concerned one regional center for the world would probably maximize the number of transport routes for the prefabricated material.

Let me give an example. Canada seems like a good country for the facility to be in, say, the Western Hemisphere. But when you look at the map and ask, "How is separated plutonium that has been put into fresh fuels returned from Canada to Chile"—well, let me pick an interior country. Most of those countries do have a coast.

Mr. LAGOMARSINO. Bolivia.

Mr. TAYLOR. Bolivia. OK. If it goes by truck it has got to go through the United States and Mexico and Latin American and Central American countries. It is exposed to the possibility of theft. So that it may be in fact that a regional center idea finally falls or doesn't depending on the extent to which either air or ship rather than truck transportation could be used.

PLUTONIUM OXIDE POWDER IN HANDS OF TERRORISTS

Mr. LAGOMARSINO. I gather when we are talking about regional centers we are talking about transportation of what would be the most dangerous, most volatile material in the hands of terrorists.

Mr. TAYLOR. It is intermediate. The most dangerous material then in the hands of terrorists is plutonium oxide powder. That would be in the regional facility. That would not be transported at all. As far as the plutonium separated from the fission product, it could be mixed with uranium to force terrorists to have to chemically separate it. That is easy to do. But there is another step you would have to go through. It also weights the stuff down. If plutonium is mixed with uranium it means one has to pick up that much more material for the weapon. That means it is that much harder to steal in the first place.

Mr. LAGOMARSINO. You talked about security. We talk about terrorists and the ability to make bombs. When you talk about blackmail do we have the ability to determine whether a given threat might or might not be a bluff? If there were any plutonium in the world unaccounted for from some of these regional centers—and I understand that is the situation already—what is to prevent someone from saying, "I have that whatever it is that is missing" and saying, "I am going to discharge a weapon unless you meet my demand?"

WHEN IS A THREAT A HOAX?

Mr. TAYLOR. As far as pointing at the material balance accounts there is no way that you can tell. That has to be a bluff because we know we are not missing any material. I am afraid that door is going to be permanently open. So far as telling whether the threat is a hoax one of the traditional ways that law enforcement people use that is very effective is that if the threat is a coercive type, "Do this or we will do that" sort of thing, and then time passes, that is a game the people play. It is very effective. It drags it out. "Look, we don't think you have a bomb."

Mr. LAGOMARSINO. "So prove it."

Mr. TAYLOR. "Prove it." It gets to be a matter of how detailed drawings might be. It might be how much sense they make. It might be some photographs. It sounds like a gamey course. But it might be policy to demand some sample, not one gram but a substantial amount, like a kilogram of the material.

Mr. LAGOMARSINO. What in your opinion is the single most contributing factor to the emergence of the terrorist threat?

QUANTITY OF MATERIALS; MAIN CONTRIBUTING FACTOR

Mr. TAYLOR. I think it is the present and prospective quantity of materials that are appearing on the world scene. I don't see any clear evidence in terrorism that there is a move toward mass destruction That is one of the comforting things.

As far as I am able to find from looking rather intensively at it the largest terrorist explosion in history was about a ton-and-a-half explosive that blew up a laboratory at the University of Wisconsin several years ago, the largest in history.

One can stuff 20 tons of explosives into any number of trucks that you can rent, you don't have to buy one. There seems to be so far some limit in the scale of violence that serves their purposes. I should say that there are also a lot of other ways of killing people in large numbers without using anything radioactive or without using nuclear weapons. These have not been used. One can only speculate why not.

I should say it is dangerous to extrapolate terrorism history from the past into the future. Let me give one example. Prior to 1970 in a study of terrorism that we did for the Defense Department we found no examples, not one, of terrorists using explosives for blackmail, that is, "Do this or we will set it off." Not one example in history.

There had been a lot of terrorist explosions before 1970. But they were out of the blue. They take credit for it afterwards, usually, not always, but never "Do this or we will do that."

So in 1970 we wrote in our report, "For some reason terrorists don't use explosives for blackmail purposes. We don't know quite why not. But let us take some comfort in that."

Six months after we published our report that first airplane incident in which exacly that happened and then the whole thing sort of caught fire. There have not been very many examples of that, I doubt if there have more than a half dozen. Past history is not always a guide to the future.

PUBLICITY INDUCES TERRORIST ACTION

Mr. LAGOMARSINO. Which brings me to the next question. A lot of people argue that discussing the subject of theft by terrorists might give a potential terrorist the idea, as if he doesn't have it already.

For example I heard a lot of criticism about "Time" magazine having a picture of Lynette Fromme on its cover after she had apparently tried to shoot the President. How do we weigh this? There is no doubt in my mind that it does have an influence on people who might be thinking about it.

Mr. TAYLOR. I certainly agree that other things being equal, the more publicity that is given to these concerns the more likely it is someone will have any idea he wouldn't have had otherwise and do something like this.

We are not talking in this subject about some temporary U.S. Government project that is going to go on for a few years and disappear. We are talking about what many people believe is within our lifetimes going to be the primary source of the main resource that drives the human system, that is, energy.

I find it unthinkable that a few people in some Government agency can take it on their shoulders to decide what kinds of safeguards, of what sort, for what purpose, and to be implemented when. It is in the best interest of all of us that it has to be discussed publicly. There are risks in doing that. There are even more serious risks if we don't.

CONCERNS ARE NOT NEW

Mr. LAGOMARSINO. It is there. If a few more terrorists get the idea——

Mr. TAYLOR. These concerns have been around in official circles for a long time. They have been discussed and worried about since at least the mid-1960's. But in terms of the actual regulations and state of security of the materials, particularly until about 1971 in the industrial sector there were no changes whatever, over a period of at least 6 years, when people were kind of thrashing around about the problem.

Mr. ZABLOCKI. I might interrupt to say that at 2:55 the bells rang indicating a vote on final passage of H.R. 8835, the Truth in Leasing Information Act. We will suspend therefore until 3:15.

Dr. Taylor, can you remain briefly? We will resume the hearing at 3:15.

[A recess was taken.]

Mr. ZABLOCKI. The subcommitte will please come to order.

Congressman Bingham will be here shortly.

Mr. Findley, do you have a question?

Mr. FINDLEY. Mr. Chairman, first of all I would like to ask consent, unanimous consent, to present several questions in writing which Dr. Taylor could answer in the printed record.

Mr. ZABLOCKI. Without objection it is so ordered.

[The questions and responses follow:]

RESPONSES BY THEODORE B. TAYLOR TO QUESTIONS SUBMITTED BY SUBCOMMITTEE

Question 1. Is there any deficiency in the NPT which contributes to the terrorist threat?

Answer. According to both the preamble and the articles in the NPT, the Treaty deals only with restrictions on *national governments'* uses of source or special fissionable materials for making nuclear explosives, not with *non-governmental* terrorist threats. The latter is left to national governments to take care of, outside the framework of NPT and the IAEA safeguards system. I see nothing in NPT, however, that would *aggravate* the terrorist threat over what it would be without NPT.

Question 2. Periodic criticism has been heard regarding alleged lax security at U.S. military nuclear installations in Germany and Turkey. Do you care to comment on that subject?

Answer. I have no current knowledge of the security at these installations, so feel unqualified to comment.

Question 3. Recent GAO studies have been critical on certain inadequate transportation and in-house security arrangements of special nuclear materials. Various recommendations were made at the time. Have you studied this question and would you care to comment?

Answer. I have reviewed the recent GAO studies in some detail, though not their classified sections. I agree with their overall findings that the security actually applied, or even called for in the regulations at the times when their studies were made (1972 and 1973, I believe) were inadequate for the protection of special nuclear materials at fixed sites and in transit. As far as I can determine, the physical security safeguards at commercial facilities in the U.S. are still not adequate, though they are generally better than they were two years ago.

Question 4. How much if any psychological analysis has been given to the issue of terrorist threat? For example, do we know enough about the profile of a potential nuclear terrorist, what motivates him, where he would be most likely to strike, etc.?

Answer. Although there has been much discussion of this subject, both within and outside the federal government, I know of no definitive studies that credibly define the most likely profiles, motivations, and possible targets of nuclear terrorists. I find all such studies to be too highly speculative to be of much assistance in helping to define the detailed characteristics that physical security systems designed to lower these risks should have. My strong conviction is that safeguards systems should be designed to be effective against all conceivable types of threats, and not dependent on particular threat analyses.

Question 5. In that same connection, can we predict the social and political circumstances that could lead to nuclear terror?

Answer. I do not believe we could make such predictions with a high level of confidence.

Question 6. What might be the impact—psychological and political—of the first nuclear terrorist act? In other words, how will various frames of reference be altered?

Answer. The psychological and political impact of the first nuclear terrorist act is unpredictable, and would depend on the detailed circumstances prior to and at the time of such an act. An act involving indiscriminate killing of a large number of people by terrorists acting in behalf of some political cause could generate practically instant, perhaps worldwide antipathy towards the terrorist organization and their cause. A highly publicized "show of strength" nuclear terrorist explosion in an unpopulated area where no one was killed, on the other hand, could conceivably cause extreme public pressure to be brought to bear on authorities to meet terrorists demands that might have rather widespread public support, such as the destruction of some major military weapons.

Question 7. What means can we take within our own governmental bureaucratic structure to lessen the terrorist threat? For example, can ERDA and NRC work more cooperatively in developing and applying safeguard techniques? Also, can we improve communications between different levels of government?

Answer. ERDA and NRC are now cooperating in *developing* safeguards techniques, but less, I believe, than they should in applying the techniques as they are developed. One area in which I am convinced there is too little cooperation between these agencies is in the establishment of classified and unclassified information channels related to nuclear weapon technology. As far as I can tell there is far too little technical expertise within NRC concerning the skills and resources required to use various forms of special nuclear materials for the illicit, clandestine construction of nuclear explosives, which is one of the primary kinds of acts that NRC is chartered to try to keep from happening. Members of the NRC staff should be sufficiently technically knowledgeable in this area to be able critically to review ERDA findings related to this subject. I feel reasonably sure that this is not the case.

I strongly endorse the recent trends towards greater involvement by Congress in issues related to nuclear terrorism and other kinds of violence that nuclear safeguards should be designed to prevent, and hope that congressional hearings and direct legislative action in this area do not gradually ease off until Congress is assured that the nuclear safeguards problems and opportunities are getting highly effective response from the Executive Branch and the nuclear industry.

Question 8. Dr. Taylor, we've been discussing the nuclear terrorist threat somewhat in the abstract. Can you tell us whether we've had any "close calls"? Also, without sounding too sinister or at the risk of being too depressing, can you predict how close we may be to an actual terrorist effort?

Answer. I know of no instances in which we have had what I would call a "close call". There have been some stated threats of nuclear violence, but as far as I know, they have all been complete hoaxes—that is, the threatened acts were completely made up, and no dangerous nuclear materials were in the possession of the threateners. As for predicting how close we may be to an actual terrorist effort, I have no basis for doing this, since I have no way of knowing whether or not there now exist groups of people or individuals who would use nuclear terrorism against society if they could. I find it credible that a real threat could develop at any time, however, and therefore have persistantly argued strongly, for ten years, that safeguards designed to make it hard to imagine a successful theft of materials for making nuclear explosives be implemented worldwide.

TIME TO MODERNIZE OUR DETERRENT

Mr. FINDLEY. Second, on the last page of your statement, Dr. Taylor, you say "to me this means a shift from offensive to defensive military strategies." For several years I have been trying to urge our Government to recognize that our doctrines and technology for Western European defense are obsolete and have very little value. I think the time has come for us to modernize our deterrent and do it making good use of smaller weapons which can have great effect without having any nuclear warheads at all.

Mr. TAYLOR. I certainly agree with that. I think we went astray sometime perhaps before World War I. We amplified it between World War I and World War II and shifted to almost complete focus on offensive weapons.

Mr. FINDLEY. I think we have to move forward with modernization of our strategy and doctrine in Western Europe.

Mr. TAYLOR. I certainly agree.

Mr. FINDLEY. Thank you, Mr. Chairman.

EFFECTIVENESS OF SALT II AGREEMENT CONTINGENT ON ITS NATURE

Mr. ZABLOCKI. Following that question, Dr. Taylor, if the United States and the U.S.S.R. reach a SALT II agreement will that necessarily stop the proliferation of nuclear weapons?

Mr. TAYLOR. That depends I think on the nature of the agreement. If it is to reduce numbers by small fractions I don't think it will have a good deal of influence on countries that really feel insecure and feel that they would be more secure if they had nuclear weapons. There is some level of nuclear disarmament or nuclear arms control by the superpowers that I think would begin to have some effect, a big effect, on other countries, particularly if these agreements were made as a sign recognizing that in fact we and the Soviet Union and China and the other two countries are less secure with these weapons than without them. I have thought this to be so ever since the Korean war. I thought at one time that the existence of nuclear weapons would make war impossible, intolerable. The Korean war proved that was wrong and the Vietnam war proved it with a vengeance. So that is no longer the conviction.

Given the fact that it has not stopped war, the existence of these weapons has not stopped war, the situation reverses and we had better find some way to get rid of them because I feel very insecure and I think all of us should, as long as these weapons are around, certainly in large numbers.

I have no formula for how far down we should go. My inclination is that having gone down very far, then we should go to zero unilaterally, provided we have developed a defensive strategy that involves a great many more things than just a sort of Maginot Line. We have to look at our institutions and make sure they are difficult to penetrate by occupation forces. I think there is a great deal of rethinking about how to react to occupation by a foreign power that is needed now.

UNITED STATES ACTING UNILATERALLY

Mr. Zablocki. My mind was with you wholeheartedly until you said "unilaterally." Then of course I froze because I can't possibly understand or imagine that if we did it unilaterally other nuclear powers would follow suit even if we had provided, as you say, an adequate defense.

Mr. Taylor. What we should search for are actions that we could take unilaterally that would in fact make us more secure. They may be very hard to find. But if we keep looking for exact parity at all times in everything we do I think we will run out of time. It is so difficult to do because agreements like the Vladivostok agreement are agreements to do something that didn't even hint at giving up anything on either side.

I am glad the agreements were reached because at least they are in the right direction. I just hope we don't relax our efforts because we succeed in getting some modicum of agreement about numbers of weapons. We have got to go much, much further and to keep hunting for things that we can do ourselves that are evidently good things to do whether some other country does it or not. It may turn out that there are no such actions. I don't know. It is worth thinking very hard about.

Mr. Zablocki. Thank you.

Mr. Bingham.

Mr. Bingham. Thank you, Mr. Chairman.

A LOOK AT THE FUEL PROCESS

Dr. Taylor, I would like to ask you about something you said on page 3 in the middle there, that it is possible to describe a facility that could reprocess with a small number of people and so on. I had understood that this reprocessing did indeed involve great difficulty because of the fact that the reprocessing of waste product involved highly radioactive material—that it is not at all simple or easy to do.

Mr. TAYLOR. I would't call it "simple." But if you visualize just what kinds of facilities are necessary to deal safely with the material—because really what I was talking about for extracting fuel from containers and chopping it up—what you need is a big swimming pool, the equivalent to a swimming pool. The water has to be something like 10 feet deep to protect people on the surface from radiation, not to the standards that are required by the industry but to standards that would involve not hurting anybody at all, that is, to deliver a total amount of radiation equal to a few chest X-rays. That is intolerable for the industry. They can't go anywhere near that. So it means being a little sloppy, if you will, on the safety end, but not to the extent that you are really harming anyone. Then the whole character changes.

The big item you need turns out to be a swimming pool that need not be any bigger than this room but has a deep end that is 10 feet deep and looks like a lot of swimming pools. The subsequent steps in reprocessing, provided one is not meeting these enormously stringent quality control and safety characteristics, could be handled without radioactive danger.

REPROCESSING: TWO-STEP PROCESS

The miles and miles of pipes and process changes and different solvents to take out each specific fission product are not required so far as the chemistry is concerned. It is a two-step process: dissolve it in acid and then precipitate out the plutonium. That is it. It has nothing to do with the processes that are used in a large commercially competitive high-quality reprocessing plant like the one in South Carolina. That is a $250 million facility. It is mind-boggling to go through. This has nothing to do with that.

Mr. BINGHAM. I am curious about a statement you make on the top of the last page where you speak of a switch from offensive to defensive military strategies. You imply that by doing this we would somehow be reducing the risk from terrorists. I don't follow your reasoning.

Mr. TAYLOR. It is somewhat circuitous. But it is something like this, that if we shift from offensive to defensive systems I think there is a good chance of being able to have an effective military system to protect us that does not require any nuclear weapons.

DISENGAGEMENT FROM NUCLEAR WEAPONS WORLD

The coupling I see between that and terrorism is that if nuclear weapons could be made to disappear from the normal kind of human activity, I think it would be much less likely that they would then appear in the abnormal type of human activity, that is, terrorists do use the kinds of things that have become traditional. They tend not to invent their own little gadgets. There are some exceptions. I suppose Molotov cocktails are the invention of terrorists. But by and large they use military weapons. They use plastic explosives that have been used for military purposes.

It is a matter of getting disengaged from a world in which nuclear weapons are part of the authorized way of doing things, to help inhibit their adoption. They are powerful. They are transportable. They are relatively cheap.

Mr. BINGHAM. So when you use the words "defensive military strategies" you aren't referring to defensive strategies relying on nuclear weapons.

Mr. TAYLOR. No. I am not talking of or including any emphasis on an ABM system, the use of nuclear warheads. I don't think that would help.

Mr. BINGHAM. Many of us are against that as a destabilizing factor even though it clearly was defensive.

Thank you.

Mr. ZABLOCKI. I would like to note that we welcome our colleague, Congressman Ottinger, and we know of your concern in this field. Do you have any questions?

Mr. OTTINGER. I am here to learn. No, thank you, Mr. Chairman.

Mr. ZABLOCKI. Thank you.

Mr. LAGOMARSINO. Can I ask one more question, Mr. Chairman?

Mr. ZABLOCKI. Certainly.

WITHDRAWING NUCLEAR WEAPONS FROM FOREIGN COUNTRIES

Mr. LAGOMARSINO. Dr. Taylor, you made two statements, one in your prepared remarks and another one in your colloquy with members of the committee. One was that we should give serious consideration to withdrawing all nuclear weapons from foreign countries and second, that we should give thought to unilateral disavowel of nuclear weapons. Is that your position?

Mr. TAYLOR. Give consideration to it; yes.

Mr. LAGOMARSINO. Let us take the first part first. If we were to withdraw nuclear weapons from Europe, particularly from Germany, would not that, assuming the U.S.S.R. did not engage in similar activity, would not that encourage West Germany perhaps, if it hasn't already done so, to develop atomic weapons of its own?

Mr. TAYLOR. Other things being equal, yes. That is why I am not just saying categorically that we should take all of our weapons and bring them back. I think we should look at it very carefully. If it turns out for example that that is the main problem, that it would encourage West Germany to develop its own weapons, that implies that there is something perhaps wrong with the logic of saying that it is not a good idea for our weapons to be over there in the first place.

In other words, if it really is so that nuclear weapons are needed, whether under U.S. control or NATO control or unilateral West German control, to protect West Germany from invasion then one might reconsider the whole thing and say "let us go back where we are now." But I am not sure that that would be the case.

NEED FOR REEXAMINATION

What I am strongly urging is that we reexamine questions without any preconceived conviction on my part that we should bring them home. My hunch is that if we really needed the kinds of actions that would be taken primarily of a defensive nature by the NATO countries in Western Europe that we can find ways to maintain a reasonably high level of security against adventures by the Soviet Union in Western Europe. I think we should look for them very hard. My hunch is that we will be able to find them. But that is just a hunch.

Mr. LAGOMARSINO. Thank you.

Mr. ZABLOCKI. Thank you, Dr. Taylor. We certainly appreciate your coming.

We will now hear Mr. Stephan Minikes, Senior Vice President of the Export-Import Bank of the United States. He will be testifying on the economic aspects of nuclear proliferation.

After Mr. Minikes we will hear Prof. Arthur Laffer.

STATEMENT OF STEPHAN M. MINIKES, SENIOR VICE PRESIDENT, RESEARCH AND COMMUNICATIONS, EXPORT-IMPORT BANK OF THE UNITED STATES

Stephan M. Minikes was elected in April 1975 by the Board of Directors of the Export-Import Bank of the United States to the position of Senior Vice President—Research and Communications.

Prior to joining the Bank, Mr. Minikes was Special Assistant and Counsel to the Chief of Naval Operations between March 1972 and June 1974. From February through April 1973, he served as Counsel to the Special Consultant to the President for Energy.

Mr. Minikes is a graduate of Cornell University (1961) and Yale University Law School (1964). From 1964 to 1972 he was engaged in general corporate and commercial law with the New York City law firms of Borden & Ball and Milbank, Tweed, Hadley & McCloy.

In addition to authoring papers on Navy and national energy matters, and contributing to a legal treatise and various Bar Association Committee Reports, Mr. Minikes is the co-author of "Federal Tax Lien Act of 1966" *New York Law Journal*, August 1967, and "Neighborhood Information Centers", *Ripon Forum*, August 1968.

Mr. MINIKES. Thank you very much, Mr. Chairman.

I have with me Mr. Stephen Goodman, who is Vice President for Policy Analysis of the Bank. I may call on him to provide any technical expertise on economic questions that you may have.

Let me say it is a pleasure to be here today to discuss with you the economic aspects of the worldwide development of nuclear power.

Rather than reading through my prepared statement, which was made available to you, what I though I might do is focus principally on the involvement of the Export-Import Bank in the financing of nuclear powerplants.

Mr. ZABLOCKI. Without objection, Mr. Minikes, your prepared statement will be made a part of the record at this point.

ROLE OF EXPORT-IMPORT BANK

Mr. MINIKES. Thank you very much, Mr. Chairman.

I thought I might take a few minutes to review with you what the Bank does. Eximbank has been instructed by Congress in its enabling legislation to foster and facilitate U.S. export sales in order to promote high levels of domestic employment and the development of this country's productive resources. It accomplishes this objective by using its resources to undertake that range and mix of programs which will be most effective in meeting foreign export credit competition, overcoming structural defects in financial and other markets, making up for shortfalls in the availability of export credit, penetrating new markets, stimulating follow-on exports, and exploiting other opportunities designed to benefit the long-term national welfare through exports.

In carrying out its mandate the Bank uses two basic tools. One is risk insurance. The other is direct lending. The primary function of the first tool, risk insurance, is to moderate the commercial and political risks involved in export financing thus enabling the private sector to undertake that level of exports and export financing which commercial considerations warrant. I might point out that over half of the Bank's total activity in dollar volume over the last fiscal year was in the risk insurance area, where the private capital markets actually provided the necessary financing while Eximbank assumed a portion of the risk of nonpayment by the foreign buyer.

The other part of the Bank's operation involves the direct lending program. The basic purpose of the Bank's lending tool is to assure U.S. manufacturers that otherwise viable export projects will have access to adequate financing.

PURPOSE OF BANK'S LENDING TOOL

The choice or mix of the tools which we use in assisting the financing for an export sale depends primarily on the nature of any given project. For example, the direct lending program generally is the program used in financing the export of nuclear powerplants, because of the amount and terms of the financing required for such projects.

The Bank does not follow any rigidly applied pattern, but rather structures its credit participation to the economics of the particular case. The interest rates which we now charge on our direct lending participation run from 8¼ to 9½ percent on the basis of a yield curve, which is purely a product of the maturities that are involved in the particular project, except in a case where we believe a lower rate is necessary in order to meet foreign export credit competition.

EXIMBANK'S DIRECT CREDIT PARTICIPATION

The direct credit participation by the Bank in a given transaction usually ranges between 30 to 55 percent of the sales price, with the balance of the financing being comprised generally of a 10-percent downpayment and the rest coming from the private commercial sector.

When there is no direct credit participation by the Bank, our guarantees on private financing of the transaction can cover up to about 85 percent of the total export value. When guarantees are combined with the direct credit participation the maximum total coverage which the Bank is prepared to make available can go as high as 90 percent. We charge a guarantee fee, of course, which ranges from three-quarters to 1½ percent.

That is basically the structure of the direct lending program.

Since 1955 there have been about 400 nuclear powerplants with a capacity of about 285,000 megawatts put under construction around the world. About 40 percent, or 175, of these plants with a capacity of about 165,000 megawatts or 60 percent of the total nuclear generating capacity are in the United States. Another approximately 125 plants represented orders from within the country of maufacturing origin. Of the remaining 100 plants, about 65 represented potential exports for the United States. Of this total the United States won 47 with Exim assisting in the financing of 37 of those. Of the 10 projects which the Bank did not assist, there were 5 in Switzerland in which there was a very small U.S. component and a strong Swiss Government presence; 2 plants were in India, which were financed by AID; and 3 small plants were put into Western Europe in the early 1960's in which there also was a very small U.S. export component.

SPAIN AND TAIWAN: EXIMBANK'S LARGEST EXPOSURE

As of September 30, 1975 Eximbank had authorized nearly $2.2 billion in direct credits and over $800 million in financial guarantees to support $3.7 billion in U.S. nuclear plant and equipment exports. Eximbank's largest exposure for nuclear projects now is in Spain and Taiwan. There are presently pending in the Bank applications relating to over $1.5 billion in U.S. exports of nuclear equipment.

The availability of financing at reasonable cost and sufficient maturity is an important element affecting our overall competitiveness in the nuclear export market. Even if U.S. equipment is competitive in terms of price, quality and delivery date, sales will be lost unless adequate financing is available.

It should be noted here that other exporters today use a combination of incentives which ranges beyond that which the U.S. Government has available to utilize in supporting export sales. Moreover, even in the few cases where only U.S. equipment presently fills the need, the buyer still has the option of deferring his purchase until foreign competitive equipment becomes available. However, there are very few if any cases that fall into that category.

PRIVATE CREDIT INADEQUATE

Eximbank is playing a major role in financing U.S. nuclear exports because adequate private financing is not available.

In our view private markets should be relied on to the fullest extent possible. We, of course, do that in furtherance of the mandate we have from the Congress to supplement but not compete with private capital. There are a number of areas however—nuclear exports probably being the most prominent—where private export credit is not available in sufficient volume and on appropriate terms because of structural defects in the financial market. This is something that has been recognized in every study of export financing and survey of the private financial community that has been undertaken. We have been involved in a number of these studies in the last couple of years in conjunction with other agencies of the Federal Government and they have unanimously come up with that conclusion.

U.S. nuclear equipment buyers generally finance their purchases through the sale of debt, often to institutional investors. These investors are generally excluded, however, from export financing because of regulation and custom. Foreign buyers are consequently forced to rely on the commercial banks. It would be impossible however for commercial banks to commit themselves to such large loans for a sufficient maturity, particularly at a fixed interest rate. Commercial banks have become increasingly reluctant to make any loans for more than 5 to 7 years from date of commitment, regardless of the underlying project economics. In the case of a nuclear plant, construction may take 5 to 7 years and then an additional 10 to 15 years will be needed to generate sufficient cash flow to repay the debt. As a result, it is simply impossible for utilities in countries such as Korea, the Philippines, Spain and Yugoslavia to raise in the private market the $500 million or more required for a single nuclear plant.

OTHER NATIONS PROVIDE NUCLEAR EXPORTS

Other suppliers provide official credit support for their nuclear exports. They provide credit that is not available in private markets, but also offer low interest rates which impart a subsidy. In recognition of the unfair advantage this gives U.S. competitors and for the sake of equity and efficiency Eximbank is directed under its current legislation to provide credit in these cases on comparable terms and conditions to those offered by the foreign export credit instrumentalities of these competitors.

The absence of Eximbank support would probably not significantly slow the worldwide development of nuclear power but it would result in a further sharp erosion of the U.S. market share. While the United States once had a near monopoly in nuclear technology to produce electric power, complete plants are now being offered by Britain, Canada, France, Germany, Japan and Sweden. Foreign producers have won more than half of the nuclear export orders so far in 1975 compared with none as recently as 1972. This is largely due to a narrowing of the price differential between the United States and foreign producers, their increased marketing efforts, and greater government financial assistance.

FOREIGN TECHNOLOGY VIEWED AS ACCEPTABLE

Foreign technology, while perhaps not on par with the latest U.S. technology in every application, is generally acceptable. U.S. suppliers of light water nuclear reactor steam supply systems no longer enjoy an advantage in terms of initial plant capital costs such as existed a few years ago.

A concensus of well-qualified nuclear power observers is that, first of all, the current cost differential, if any, is so slight in favor of either United States or foreign suppliers as not to be a major factor in the selection of a reactor supplier; second, the political/commercial history, country situation, and product workload variables associated with any particular international tender far outweigh any apparent cost differentials, and third, the significant factors influencing the selection of U.S. suppliers have been and continue to be a somewhat superior technology, and advanced design and operational maturity, including a demonstrated track record and the availability of official financing support. Given the huge capital requirements and long repayment periods required by nuclear powerplants, financing competition has become even more important as small differences in the level or type of financing can have a significant impact on total costs. This is especially evident when you are dealing with a 1 or 1½ percentage difference in a project where you are talking $500, $600, $700, $800 million.

A LOOK AT EXPORT COMPETITORS

The major foreign competitors for the United States are West Germany, France and Canada. In total these countries have won 14 export orders since 1971. West Germany has won 8 orders, France 4, and Canada 2. The United Kingdom has had technological problems and may not be a strong competitor for some time. Japanese and Swedish producers have been more oriented toward their domestic markets, but they are now becoming more interested in exporting. The Soviet Union has been an active competitor only in Eastern Europe and Finland. The Germans made a dramatic breakthrough in Brazil by offering a full range of nuclear technology in exchange for long-term uranium supply contracts.

The export thrust by the French and Germans in the nuclear power field stems from their announced decision to increase their exports of high-technology equipment both for political and economic reasons. Given the exigencies of the energy crisis, it was logical for them to select nuclear power for a special effort. This has meant offers to the more advanced "Third World" countries not only of nuclear powerplants but also of reprocessing facilities, guarantees of enrichment services, and favorable financing.

EXPANSION OF FOREIGN NATIONS' CAPACITIES

Foreign nuclear equipment capacity has been expanding rapidly in recent years. Germany and France, the largest producers outside the United States, are now each capable of producing six or seven units a year. Canadian and Swedish producers can each build two or three plants annually. This 20-plant potential is double the foreign capacity of only a few years ago. The domestic market in each of the supplier countries absorbs about one-half of their total capacity, leaving a potential of 9 to 10 units for export. With additional countries such as Japan entering the export area and with present suppliers continuing to expand their capacity, foreign competition should continue to increase in the years ahead.

The financing of nuclear powerplants is receiving priority treatment by export credit agencies in Germany, France, Canada, and Sweden. A $380 million nuclear plant order in Spain, for example, was lost to a German supplier who benefited from official financial support, including financing of one-third of the contract at an interest rate of 7.25 percent. This is one-half percent below the most preferential rate supported by the German Government and normally available on German exports.

We have been working for almost 2 years with the other major exporting nations of the world to reach an agreement on the provision of export credit, but unfortunately to this moment have been unsuccessful in this area.

NPT ADHERENCE SEEN AS DESIRABLE

In focusing my discussion on the economic aspects of the worldwide development of nuclear power, I do not wish to gloss over the great dangers inherent in nuclear proliferation. The Bank is very much aware of this problem and is sympathetic to the concerns you and your colleagues, both in the House and the Senate, have expressed.

Universal adherence to the NPT is a desirable objective. The international controls contained in the commitments of this treaty are probably the best guarantees that can be obtained from sovereign governments regarding their peaceful intentions in the use of the atom. Unfortunately, the United States no longer has the leverage to force other nations to sign the treaty if they wish to obtain nuclear facilities, because a number of countries are now in a position to supply potential buyers. These suppliers do not require that buyers adhere to the NPT, although they do impose bilateral safeguards similar to those the United States imposes in the case of sales to nonsignatories.

Moreover from a nonproliferation perspective, the use of U.S. nuclear equipment has certain inherent advantages:

U.S. light water reactors produce less fission products, especially plutonium, than do competing designs using natural uranium.

ADVANTAGES OF U.S. LIGHT WATER REACTORS

U.S. light water reactors use enriched uranium as a fuel, the control of which the United States currently nearly monopolizes. Dependence on the United States for enriched uranium supplies would therefore tend to operate as an incentive for compliance with nonproliferation provisions. In contrast, Canadian reactors and those of several other countries use natural uranium, which is relatively abundant and is available from many sources around the globe.

Finally, advanced U.S. technology in reactor design and control systems makes inspection and control over fission products easier. Thus, if the United States builds the plant and supplies the enriched fuel there is less likelihood of diversion for unauthorized purposes.

Most important, in our view, the Bank is not the best instrument—as it is designated to be under several pieces of proposed legislation that have been introduced in Congress—nor are export credits the best lever to use in seeking to induce countries to sign the Non-Proliferation Treaty. The Bank has both the legislative directive and professional competence to make economic and financial judgments, but it does not have the capacity to properly address the proliferation issue as part of the loan evaluation process. We believe that current laws provide ample authority to those agencies with the competence in this field to control the export of nuclear material and facilities and to use this control, if so desired, to induce countries to adhere to the Non-Proliferation Treaty.

SURVEY DEMONSTRATES LENDING PRACTICES

A survey we have just completed of the lending practices of official export credit agencies in other nuclear suppliers indicates that, in every country surveyed, the export credit agencies assess the economic and financial merits of the credit, while the nuclear regulatory and control agencies use their export control authority to regulate the export of nuclear plant and equipment to countries which have not agreed to adequate safeguards.

Prior to Eximbank action, all applications for preliminary commitments and direct credits for nuclear plants are referred by Eximbank to the Department of State for appropriate review. Eximbank has been advised by the Department of State that in the case of those applications for nuclear energy products and services their review has included referral to the Arms Control and Disarmament Agency. In addition Eximbank has sought advice on nuclear energy transactions from the Energy Research and Development Administration and the Federal Energy Administration. Eximbank now also refers all nuclear energy transactions to the Interagency Nuclear Proliferation Backstopping Committee, on which ERDA, State, and ACDA are represented.

Transactions involving an Eximbank liability of $30 million or more are reviewed prior to final Eximbank action by the National Advisory Council on International Monetary and Financial Policies, an interagency group that includes the Secretaries of State, Treasury, and Commerce, the Chairman of the Board of Governors of the Federal Reserve System, and the President of the Export-Import Bank. In those instances where Eximbank liability is $60 million or more each case is submitted for congressional review prior to final authorization. That provision was incorporated in the Bank's charter by legislation enacted by the Congress last year. Therefore, as a practical matter, the Congress is automatically notified of all nuclear power cases being considered by Eximbank and has an opportunity to consider the merits and issues involved.

Eximbank supports the objective of the concurrent resolution but is concerned that adoption of this resolution would be misinterpreted by the world as a signal that Congress intends the United States to withdraw unilaterally from the world nuclear export market. Any such misinterpretation would certainly work against the best interests of the United States.

[Mr. Minikes prepared statement follows:]

PREPARED STATEMENT OF STEPHAN M. MINIKES

Mr. Chairman, Members of the Committee, it is a pleasure to be here today to discuss with you the economic aspects of the worldwide development of nuclear power. I would like to share with you our forecast of world nuclear power development over the next several years and our views regarding the benefits to the U.S. economy of sharing in this growing market. I will also indicate what role Eximbank plays in facilitating U.S. exports of nuclear power plant and equipment. Finally, I will share with you Eximbank's views regarding House Concurrent Resolution 371 particularly clause (3).

DIMENSIONS OF THE MARKET

Worldwide demand for electric power has increased over the last 15 years at an average annual rate of nearly 10%. The growth in world electricity demand has slowed recently as a consequence of the worldwide economic downturn, rising prices for electricity and other energy, and increased energy conservation. It is expected however, that as the economic recovery now underway gains momentum, electricity demand will again expand rapidly, albeit at rates somewhat below those of the 1960's.

A variety of primary energy sources can be used to produce electricity—hydro and geothermal power; fossil fuels, such as oil, coal, and gas; and nuclear energy. The high and increasing cost of crude oil and the desire of a large number of countries to increase their energy independence has encouraged development of alternative primary energy sources. Major new hydro potentials exist in only a few locations in South America, Africa, and the Far East; geothermal power, given present technology, is also limited to a few favorable locations. Coal offers substantial substitution possibilities in power generation, but coal with a low sulfur content is scarce, and the technology is not yet developed to eliminate sufficient sulfur at low enough cost to make coal a preferred substitute to oil. Moreover, concern about the possible adverse impact on the environment has restricted the use of strip mining, the most economical way to mine coal. Natural gas is too valuable and scarce to use as a boiler fuel. Consequently, countries throughout the world are pursuing plans for nuclear power development to meet their future energy needs.

Nuclear power has been used to generate electricity on a commercial scale since the mid-1950's. Until recently, however, the size of installed capacity was limited by both technology and high capital costs. Plants were built for the purpose of gaining construction and operating experience, rather than for the inherent economy of nuclear power. It was not until electric utilities gained confidence in the reliability and potential competitiveness of nuclear power stations that commercial plants began to be constructed on a large scale. The surge of installation in the early 1970's was still more in anticipation of favorable cost conditions than a reflection of actual operating economies at that time.

In late 1973 and early 1974, a dramatic shift occurred in the relative economics of nuclear and fossil-fueled generating stations.

Today, nuclear power is the preferred fuel because of the fuel savings that can be achieved. For example, a 600 thousand kilowatt (kw) (1 megawatt=1,000 kw) nuclear power plant, operating at 70% capacity, saves 15,000 barrels of oil per day or 5.5 million barrels per year. At a cost of $14 per barrel, this represents a savings of $77 million annually. The capital costs of a nuclear plant are, of course, higher. Exactly how much higher is difficult to indicate precisely as the prices of both types of plants have been increasing sharply. Recent figures for projects supported by Eximbank show an investment cost of $1,135 per kw of installed capacity for a nuclear plant and $950 per kw for a fossil fuel plant. In previous cases, the differential in favor of conventional fossil fuel plants was considerably greater.

In terms of reliability of supply, the nuclear plant also has distinct advantages. Once a fuel load is installed, the energy supply is at hand for several years and at a predetermined and fixed cost. Also, being in debt to the United States or another major industrialized country for a nuclear fuel load may be considerably more attractive to a buyer than being vulnerable to sharp fluctuations in oil prices for an equivalent oil supply.

At the end of 1974, about 56 million kw in nuclear power generating capacity had been installed in developed countries. Fifty-five nuclear power plants, with a total capacity of about 40 million kw, were licensed to operate in the United States. The August 1975 forecast of the International Atomic Energy Agency for the developed nations as a whole, calls for 173 million kw in nuclear power generating capacity in 1980 and 436 million kw in 1985. This would require the completion of just under 400 nuclear power plants of 1 million kw or more each, each with a price tag of about $1 billion.

Despite recent slowdowns in nuclear power development, nuclear generating capacity is expected to provide the equivalent of 4.6 million barrels of oil per day by the end of 1980—roughly 5% of total world energy requirements. A substantial slippage in these plans is unlikely, given the long lead time required to bring a nuclear plant on line. Most plants expected to be in operation in 1980 are already under construction. Completion of these projects and the undertaking of the new larger scale projects required to meet the 1985 goal will, however, require vast amounts of new capital.

BENEFITS TO THE U.S. ECONOMY

The benefits to the U.S. economy of sharing in the growing worldwide market for nuclear power plants are enormous. It will mean increased exports which will allow us to continue to pay for needed resource and other imports without depreciating the dollar and thereby exacerbating domestic inflation. Nuclear exports will also create additional jobs and raise our national income. Finally, it will allow U.S. manufacturers to spread huge research and development costs over a larger number of units, thereby lowering per unit installation costs and contributing to the growth in productivity and diffusion of technology gains throughout the economy.

On the basis of projections provided to us by the Energy Research and Development Agency, other government agencies, and the principal U.S. exporters—the General Electric Company and Westinghouse—Eximbank's staff estimates that world investment in new nuclear power plants in the 1976–1978 period will total about $105 billion. The great bulk of this investment will be in equipment and services that can be provided by the countries in which the plants are located. Nevertheless, export orders for nuclear power plant and equipment will total about $27 billion during the period. If adequate financing is available in the United States, we believe that U.S. exporters can obtain some $10 billion in export orders in the 1976–1978 period. Other estimates of U.S. nuclear export orders over the three-year period range up to $30 billion.

The U.S. economy will benefit directly and indirectly from these exports. Estimates derived by the Labor Department and the Bank's staff indicate that about 35,200 jobs are now associated, directly or indirectly, with each billion dollars in nuclear plant and equipment exports. The export orders expected to be won over the next three years consequently will generate employment for about 120,000 workers annually. Moreover, these are jobs in the large firms and numerous small subcontractors in the high-technology industries which have the highest wages and best working conditions.

U.S. national income and tax receipts will also grow as our nuclear plant and equipment exports expand. The Commerce Department estimates that $2.0 billion is added to the GNP for each billion dollars in exports. In turn, an estimated $400 million in additional tax revenue is generated. The export of $10 billion in nuclear plant and equipment during the 1976–1978 period consequently will add almost $7 billion a year to U.S. GNP and generate over $1.3 billion annually in additional tax revenue. (I might add that this $1.3 billion in additional tax revenue alone is somewhat more than the projected annual level of Eximbank direct credit authorizations in support of U.S. nuclear exports during the period—authorizations that will be repaid to Eximbank with interest.)

By supplying the export market, U.S. manufacturers of nuclear plant and equipment will be able to spread their huge research and development costs over a larger number of units and exploit economies of scale in production. At the beginning of 1975, U.S. suppliers of nuclear equipment had completed 19 plants overseas or about 20% of their total production. The larger sales volume enabled them to produce at a substantially lower cost and offer a lower price to their customers, a majority of whom are U.S. utilities.

An important indirect benefit of nuclear exports for the U.S. and the world economy is the effect it has in reducing worldwide reliance on fossile fuels, particularly oil and most espectially OPEC oil. Each one million kw nuclear power plant results in a savings of the equivalent of 9.4 million barrels of oil per year (or 2.5 million tons of coal or 56 billion cubic feet of natural gas). The $100 billion in worldwide nuclear investment projected for the 1976–1978 period represents 140 million kw of new capacity. This translates into a yearly savings of 1.3 billion barrels of oil (or about 364 million tons of coal or 7.84 trillion cubic feet of natural gas) which is roughly twice the annual crude oil production of a major oil producer such as Kuwait.

These positive economic benefits are not reduced by possible offsetting economic disadvantages as may sometimes be the case with other exports. The output of foreign nuclear plants can never come back to the United States and displace U.S. workers; indeed, as has been indicated, the additional energy that is generated helps reduce U.S. and worldwide dependence on potentially unreliable energy sources.

The export of nuclear power plant and equipment similarly does not lengthen lead times for domestic nuclear power projects. Foreign orders, in fact, have allowed U.S. manufacturers to keep their production facilities operating at efficient levels and have encouraged capacity expansions to meet future U.S. and world needs.

The world market for nuclear power plants has remained relatively strong, while the U.S. market has turned sharply down. In the first six months of 1975 U.S. utilities cancelled or deferred about 100 million kw of nuclear capacity—

about 50% of their total nuclear orders. U.S. manufacturers of nuclear power equipment have been able to avoid shutdowns in capacity only on the strength of their foreign sales. U.S. nuclear plant manufacturers have the capacity to produce 25 to 30 nuclear plants a year. Because of the cancellation and deferral of many domestic orders output in the 1975–1980 period will not exceed 15 to 17 plants a year in the absence of new export orders.

The principal component in a nuclear power plant is the reactor vessel. The size of the vessel is the principal factor limiting the number of units that can be produced. At present, there is no shortage in vessel capacity. Moreover, the Federal Energy Administration does not expect that export demand will create any problems in meeting domestic vessel needs. Although some of the materials required in the construction of nuclear plant equipment—heavy steel plate, stainless plate, castings, forging, and certain special welding rods—have been in short supply in the recent past, no scarcity now exists or is expected to emerge over the next several years.

ROLE OF EXIMBANK

In the last 20 years, U.S. manufacturers have supplied the equipment for 47 nuclear projects outside the United States. Eximbank has supported 37 of these projects. The 10 projects not assisted by Eximbank were "exceptional" cases: 5 plants in Switzerland where the U.S. component was small and where there was a strong Swiss government presence, 2 plants in India financed by AID, and 3 small plants in Western Europe in the early 1960's which also had a small U.S. component.

As of 30 September 1975, Eximbank had authorized nearly $2.2 billion in direct credits and over $800 million in financial guarantees to support $3.7 billion in U.S. nuclear plant and equipment exports. Eximbank's largest exposure for nuclear projects is in Spain and Taiwan. There are presently pending in the Bank applications relating to over $1.5 billion in U.S. exports of nuclear equipment.

The availability of financing at reasonable cost and sufficient maturity is an important element affecting our overall competitiveness in the nuclear export market. Even if U.S. equipment is competitive in terms of price, quality, and delivery date, sales will be lost unless adequate financing is available. Even in the few cases where only U.S. equipment presently fills the need, the buyer still has the option of deferring his purchase until foreign competitive equipment becomes available.

Eximbank is playing a major role in financing U.S. nuclear exports because adequate private financing is not available. In our view, private markets should be relied on to the fullest extent possible. There are a number of areas, however—nuclear exports probably being the most prominent—where private export credit is not available in sufficient volume and on appropriate terms because of structural defects in the financial market. This is something that has been recognized in every study of export financing and survey of the private financial community.

U.S. nuclear equipment buyers generally finance their purchases through the sale of debt, often to institutional investors. These investors are geneally excluded, however, from export financing because of regulation and custom. Foreign buyers are consequently forced to rely on the commercial banks. It would be inappropriate, however, for commercial banks to commit themselves to such large loans for a sufficient maturity, particularly at a fixed interest rate. Commercial banks have become increasingly reluctant to make any loans, for more than five years from date of commitment, regardless of the underlying project economics. In the case of a nuclear plant, construction may take five to seven years, and then an additional ten to fifteen years will be needed to generate a sufficient cash flow to repay the debt. As a result, it is simply impossible for utilities in countries such as Korea, the Philippines, Spain, and Yugoslavia to raise in the private market the $500 million or more required for a single nuclear plant.

Other suppliers provide official credit support for their nuclear exports. They provide credit that is not available in private markets, but also offer low interest rates which impart a subsidy. In recognition of the unfair advantage this gives U.S. competitors and for the sake of equity and efficiency, Eximbank is directed under its current legislation to provide credit in these cases on comparable terms and conditions.

The absence of Eximbank support would probably not significantly slow the worldwide development of nuclear power, but it would result in a further sharp erosion of the U.S. market share. While the United States once had a near monopoly in nuclear technology to produce electric power, complete plants are now being offered by British, Canadian, French, German, Japanese, and Swedish manfacturers. Foreign producers have won more than half of the nuclear export orders so far in 1975 compared with none as recently as 1972. This is largely due to a narrowing of the price differential between the U.S. and foreign producers, their increased marketing efforts, and greater government financial assistance.

Foreign technology, while perhaps not on par with the latest U.S. technology in every application, is generally acceptable. U.S. suppliers of light water nuclear reactor steam supply systems no longer enjoy an advantage in terms of initial plant capital costs such as existed a few years ago. A consensus of well-qualified nuclear power observers is that: (1) the current cost differential, if any, is so slight in favor of either U.S. or foreign suppliers as not to be a major factor in the selection of a reactor supplier: (2) the political/commercial history, country situation, product workload variables associated with any particular international tender far outweigh any apparent cost differentials; and (3) the significant factors influencing the selection of U.S. suppliers have been, and continue to be, a somewhat superior technology, the advanced design and operational maturity, including a demonstrated track record, and the availability of official financing support. Given the huge capital requirements and long repayment periods required by nuclear power plants, financing competition has become even more important, as small differences in the level or type of financing can have a significant impact on total costs.

The major foreign competitors are West Germany, France, and Canada. In total, these countries have won 14 export orders since 1971 (West Germany has won 8 orders, France 4, and Canada 2). The United Kingdom has had technological problems and may not be a strong competitor for sometime. Japanese and Swedish producers have been more oriented toward their domestic markets, but they are now becoming more interested in exporting. The Soviet Union has been an active competitor only in Eastern Europe and Finland. The Germans made a dramatic breakthrough in Brazil by offering a full range of nuclear technology in exchange for long-term uranium supply contracts.

The export thrust by the French and Germans in the nuclear power field stems from their announced decision to increase their exports of high-technology equipment, both for political and economic reasons. Given the exigencies of the energy crisis, it was logical for them to select nuclear power for a special effort. This has meant offers to the more advanced "third world" countries not only of nuclear power plants but also of reprocessing facilities, guarantees of enrichment services, and favorable financing.

Foreign nuclear equipment capacity has been expanding rapidly in recent years. Germany and France, the largest producers outside the United States, are now each capable of producing six or seven units a year. Canadian and Swedish producers can each build two or three plants annually. This 20-plant potential is double the foreign capacity of only a few years ago. The domestic market in each of the supplier countries absorbs about one-half of their total capacity, leaving a potential of nine to ten units for export. With additional countries such as Japan entering the export arena, and with present suppliers continuing to expand their capacity, foreign competition should continue to increase in the years ahead.

The financing of nuclear power plants is receiving priority treatment by export credit agencies in Germany, France, Canada, and Sweden. A $380 million nuclear plant order in Spain, for example, was lost to a German supplier who benefited from official financial support, including financing of one-third of the contract at an interest rate of 7.25%. This is ½% below the most preferential government-supported interest rate normally charged on German export credits and represents a special incentive for nuclear power exports. We are seeking in ongoing international negotiations to increase the minimum interest rate support by export credit agencies for nuclear equipment, as well as exports.

NUCLEAR PROLIFERATION

In focusing my discussion on the economic aspects of the worldwide development of nuclear power, I do not wish to gloss over the great dangers inherent in nuclear proliferation. The Bank is very much aware of this problem and is sympathetic to the concerns you and your colleagues, both in the House and the Senate, have expressed. Nevertheless, in the Bank's view, the proposed Concurrent Resolution would not be in the best interests of the United States.

Universal adherence to the Non-Proliferation Treaty is a desirable objective. The international controls contained in the commitments of this treaty are probably the best guarantees that can be obtained from sovereign governments regarding their peaceful intentions in the use of the atom. Unfortunately, the United States no longer has the leverage to force other nations to sign the treaty if they wish to obtain nuclear facilities, as a number of suppliers abroad are now in a position to provide technically advanced and financially competive nuclear plant offers. These suppliers do not require that buyers adhere to the Non-Proliferation Treaty, although they do impose bilateral safeguards similar to those the United States imposes in the case of sales to nonsignatories.

Moreover, from a non-proliferation perspective, the use of U.S. nuclear equipment has certain inherent advantages:

U.S. light water reactors produce less fission products, especially plutonium, than do competing designs using natural uranium.

U.S. light water reactors use enriched uranium as a fuel over the supply of which the United States currently has a near monopoly. Dependence on the United States for enriched uranium supplies would tend to create an incentive for compliance with nonproliferation provisions. In contrast, Canadian reactors and those of several other countries use natural uranium, which is relatively abundant, and is available from many sources around the globe.

Advanced U.S. technology in reactor design and control systems makes inspection and control over fission products easier. If the United States builds the plant and supplies the enriched fuel, there is less likelihood of diversion for unauthorized purposes.

Most important, in our view, the Bank is not the best instrument, or export credits the best level, to use in seeking to induce countries to sign the Non-Proliferation Treaty. The Bank has both the legislative directive and professional competence to make economic and financial judgments, but it does not have the capacity to properly address the proliferation issue as part of the loan evaluation process. We believe that current laws provide ample authority to those agencies with the competence in this field to control the export of nuclear material and facilities and to use this control, if so desired, to induce countries to adhere to the Non-Proliferation Treaty.

A survey we have just completed of the lending practices of official export credit agencies in other nuclear suppliers indicates that, in every country surveyed, the export credit agencies assess the economic and financial merits of the credit, while the nuclear regulatory and control agencies use their export control authority to regulate the export of nuclear plant and equipment to countries who have not agreed to adequate safeguards.

Prior to Eximbank action, all applications for preliminary commitments and direct credits for nuclear plants are referred by Eximbank to the Department of State for appropriate review. Eximbank has been advised by the Department of State that in the case of those applications for nuclear energy products and services, their review has included referral to the Arms Control and Disarmament Agency (ACDA). In addition, Eximbank has sought advice on nuclear energy transactions from the Energy Resource and Development Agency (ERDA) and the Federal Energy Administration. Eximbank now also refers all nuclear energy transactions to the Interagency Nuclear Proliferation Backstopping Committee, on which ERDA, State, and ACDA are represented.

Transactions involving an Eximbank liability of $30 million or more are reviewed prior to Eximbank action by the National Advisory Council on International Monetary and Financial Policy, an interagency group that includes the Secretaries of State, Treasury, and Commerce, the Chairman of the Board of Governors of the Federal Reserve System, and the President of the Export-Import Bank. In those instances where Eximbank liability is $60 million or more, each case is submitted for Congressional review prior to final authorization. Therefore, as a practical matter, the Congress is automatically notified of all nuclear power cases being considered by Eximbank and has an opportunity to consider the merits and issues involved.

Eximbank supports the objective of the Concurrent Resolution, but is concerned that adoption of this resolution would be misinterpreted as a signal that Congress intends the United States to withdraw unilaterally from the world nuclear export market. Any such misinterpretation would certainly work against the best interests of the United States.

Mr. Zablocki. Thank you, Mr. Minikes.

Mr. Laffer, will you proceed please?

STATEMENT OF ARTHUR LAFFER, ASSOCIATE PROFESSOR OF BUSINESS ECONOMICS, GRADUATE SCHOOL OF BUSINESS, UNIVERSITY OF CHICAGO, AND CONSULTANT TO THE SECRETARY OF THE TREASURY

Arthur B. Laffer has been Associate Professor of Business Economics at the University of Chicago since 1970. Mr. Laffer is also a consultant to the editorial page of The Wall Street Journal, to the Secretary of the Treasury, principal consultant to H. C. Wainwright and Company, and editor of Marcel Dekker, Inc. series on Economics, Finance and Business. He recently co-chaired the University of Chicago—First National Bank of Chicago Conference on World Economic Stabilization with Eugene A. Birnbaum.

He served as the Economist, Office of Management and Budget from October 1970 through July of 1972, on leave of absence from the University of Chicago, where he has been a faculty member since 1967.

From 1967 to 1968, Mr. Laffer was a Research Associate at the Brookings Institution and on leave from the University of Chicago. Before that time, he worked on a part-time or summer basis as financial analyst at Ford Motor Co., research economist at the Federal Reserve Bank of Cleveland, research assistant to Professor Moses Abramovitz at Stanford University, and acting instructor in economics at Stanford University.

Since 1968, Mr. Laffer has also served as a consultant to the Council of Economic Advisers and to the White House.

Mr. Laffer received a B.A. in Economics from Yale University in 1963, prior to which he also attended the University of Munich, Germany. He received an MBA (1965), and a Ph.D. in Economics (1972) from Stanford University.

Mr. Laffer. Thank you very much, Mr. Chairman, members of the committee. It gives me great pleasure to be here today. If you don't mind, Mr. Chairman, perhaps I could have my testimony placed in the record and I will just sort of summarize it.

Mr. Zablocki. Without objection, your prepared testimony will be made a part of the record.

Mr. Laffer. Thank you. I will just summarize it fairly briefly. My interest in Eximbank started about the end of 1970 when I joined the Office of Management and Budget. Since then I have been following the economic aspects of Eximbank quite closely.

Eximbank has been justified historically on basically five grounds, five economic grounds. The first one is that basically Eximbank increases the amount of exports or in some sense leads to export expansion.

Another ground is that it has been alleged that the Eximbank activities lead to an increase in the U.S. trade balance. Along these same lines an increase in the trade balance would lead to an increase in domestic employment, it was argued. And it was argued that an increase in the trade balance would lead to improving the U.S. balance of payments. So there are four closely related arguments to trade.

The fifth argument used to justify the Export-Import Bank's activities is to eliminate distortions in the capital market with regard to exports.

SUMMARIZATION OF FIVE ECONOMIC GROUNDS

I would like to discuss each one of these very briefly and not go into elaborate economic analysis. I will summarize my views.

From the point of view of economic theory there is an optimal level of trade. If we are at the optimal level we are at the best level we can possibly be. If trade is less than at the optimal level we would be better off expanding trade. If trade is above the optimal level we would be better off retracting trade and decreasing it. So from the pure standpoint of looking at trade from sort of an aggregate standpoint one has to have a presumption that somehow we are trading less than we should to want to necessarily increase total trade.

If we are at a suboptimal level of trade there are several reasons why we could be there. One reason could be that we have tariffs and quotas on imports which would lead to less imports and less exports than we would otherwise like.

If you have a suboptimal level because of quotas and tariffs clearly the practical way of dealing with this situation would be to eliminate the tariffs and quotas and not to try to counterbalance one distortion with another distortion in the system.

If trade is at a suboptimal level because of foreign quotas or foreign tariffs or foreign taxes again the best policy here would be to reduce foreign quotas, to reduce foreign tariffs, to reduce foreign taxes such that we get to the optimal level.

Again, if we use the Eximbank to increase trade when in fact there are foreign quotas and tariffs effectively what we are allowing foreigners to do is to tax U.S. residents: that is, we would be worse off than if we didn't subsidize total exports.

OVERALL TRADE BALANCE OF THE UNITED STATES

The second aspect of the economic justification is with regard to the overall trade balance of the United States.[1] This argument was used extensively a while ago although it hasn't been used much lately. The only reason the United States exports is to be able to import. The more the United States exports the more the United States imports. It is very similar to an individual working. The only reason one works is to be able to consume. If you prohibited a person from consuming he would shortly stop working. Likewise the only reason the United States exports is to be able to purchase foreign goods.

There is no presumption whatsoever that if we increase total exports in any one time period that we will improve our trade balance. We have no notion whatsoever, whether imports increase by less than, more than, or equal to the amount our exports increase. Those countries with a high level of exports also have a high level of imports. Likewise those countries with a very large share of exports also have a very large share of imports.

Trade balances are not associated with the total level of exportation of a country. George Shultz argued a while ago that if we really want to increase the exports and the trade balance of the United States we can do it very easily by just giving away our goods. Clearly that is not what we are after.

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[1] For additional comments on Mr. Laffer's statement on the overall trade balance of United States as well as comments on other aspects of his testimony see Eximbank's submittal on p. 126 together with Mr. Laffer's response on p. 128.

SUBSIDIZING EXPORTS

Export subsidies effect on domestic employment is that if we do subsidize exports and exports increase then we do gain domestic employment in export industries. There is no question of that whatsoever. However by having more imports come into the country we lose simultaneously employment in the import substitute industry. In other words by increasing our exports of one product we increase our imports of another product and we lose employment in the import substitute industries.

When you want to move in the way of subsidizing total exports what you are really doing is subsidizing employment in the export industry at the expense of import substitute industries. The aggregate employment effect is far from clear. A priori there is no reason to expect that total employment in the United States would be improved whatsoever by an increase in subsidies of total exports.

OVERALL BALANCE OF PAYMENTS

The next question I would like to go to is the overall balance of payments. Again this is a direct extension of the trade balance analysis where we cannot find any overall association with subsidies to exports and improvement in the trade balance. Likewise there is no reason to expect any overall improvement in the balance of payments of a country because it subsidizes exports. We do increase the volume of trade, true. But we don't improve the trade balance nor do we improve the overall balance of payments.

As a lot of research has shown, the balance of payments is primarily a monetary phenomenon and as such the Export-Import Bank or many of the other programs do not influence these overall monetary variables.

The last argument, which has some justification and which has been used a great deal more recently, is that there are imperfections in the long-term capital market. As such one could argue that when capital is not available and when funds aren't available for people to borrow or to lend at long-term rates, perhaps it would be a good idea to have a U.S. Government agency in this long-term capital market providing capital. This is clearly a correct argument in the aggregate.

WHY NOT FINANCE IMPORTS?

However before one can say that it should be done by something like the Export-Import Bank subsidizing or providing capital for long-term export markets, I ask myself the question why shouldn't we likewise provide lending markets for long-term imports? Why should we restrict it so strictly export financing as opposed to import financing? Why do we solely provide this long-term capital market to export financing? It seems to me that there is no explicit reason why long-term export financing should be available as opposed to long-term import financing or intra-U.S. trade financing.

To decide that there was an imprefection in the long-term capital market, is far from obvious to me.

If you look at some of the financing companies of early Britain, the Hudson Company and a lot of others we found that then they could finance very long-term and highly risky ventures in the private capital market. If, however, we did decide there was an imperfection in the long-term capital market one would never wish to lend at below market rates. All you would want to do is make available financing at the going market rate. You never would like to have subsidized rates.

EMPHASIZING LOAN SUBSIDIES SEEN AS INAPPROPRIATE

To summarize the economic aspects I would like to go to one point that has been used quite often. A lot of people justify Export-Import subsidies on loans because foreigners do it. That seems to me to be totally inappropriate logic. If foreigners throw away their money I don't see why the United States would like to follow suit just because they are doing it. Subsidies are inefficient in general. If foreigners want to subsidize their exports and give us their goods free, why should we then turn around and decide to give them our goods free? It is totally inappropriate to say that because they do it therefore we have to match it. I don't see the logic in that argument.

I find very little reason to justify the U.S. Export-Import Bank activities. I don't think that they do much good. But I think on the other side of the coin they cost a lot. If you look at the rate of growth of the Export-Import Bank activities over the past 10 or so years we find they have grown very rapidly. If we were to include them back in the budget, which I guess will occur next year, 1977, I think you would find that their outlay numbers are growing at a rapid clip. It is part of the whole inherent problem of the budget and the growth of outlays. It seems to me that this is one aspect that even though we don't include them in totals anymore they still have the same economic impact as before. They are expensive.

To take us over to the point at hand on the nuclear issue I——

Mr. Zablocki. I am afraid before you go into the concluding part of your statement there is a roll call on final passage of Senate bill 2195, the Natural Productivity and Quality of Working Act of 1975. The subcommittee, therefore, will suspend for 5 minutes while we answer the call.

[A recess was taken.]

Mr. Zablocki. The subcommittee will resume the hearing.

Mr. Laffer, will you continue?

THEOREMS ALONG LINES OF DISTORTIONS

Mr. Laffer. Thank you. I just have one last point to make. There are reasons in the economic literature when one would like to either subsidize trade or hinder trade. The theorems are along the lines of distortions. If you do have an international trade distortion then you do wish to either subsidize trade if it is an external economy or you wish to distort trade the other way, that is, prevent trade if you have an external diseconomy.

One of the reasons often given in the economics literature for why one would want to prohibit trade is when there is anything involving the national security or other types of political reasons for not wanting certain goods outside of the United States.

While I am no expert whatsoever on nuclear technology, fuel or powerplants, it would seem to me that from all the analogies that have been used in the economics literature that nuclear fuel technology and powerplants could very easily fit into this type of category.

It seems to me if there were a distortion it would be an external diseconomy and one would not want to foster rapid expansion of exports unless it were in the national interest. I concur with Congress' attitude of looking at this issue very seriously and whether we do want to have a lot of trade in these nuclear products.

[Prepared statement of Professor Laffer follows:]

PREPARED STATEMENT OF ARTHUR LAFFER

Mr. Chairman, thank you very much for inviting me to testify before your Subcommittee today. I think the issue raised at this hearing is far more important than it is often given credit.

In light of my comments today I will omit elaborate discussion of many of the familiar propositions found in international trade theory. For the non-economist, explanations of these propositions appear far too complicated and arcane, while to the professional they border on the obvious. Therefore, I shall just state the propositions and proceed on to their relevance with regard to the issue at hand.

The Export-Import Bank's activities are often justified in terms of stimulating exports, improving the United States trade balance, relieving domestic unemployment, improving the U.S. balance of payments, and alleviating distortions in the capital market.

From the point of view of trade theory there is an "optimal" amount of trade. Whenever trade is less than the "optimal" amount there are gains to be acquired by expanding trade. However, in precise symmetry, whenever trade exceeds the "optimal" amount losses occur when trade is expanded. Trade expansion *per se* is not necessarily good.

Even if trade is considered to be suboptimal, there are numerous means at hand to provide for the expansion of trade. From a policy standpoint, we should not be indifferent as to the method used.

To the extent that trade is suboptimal because of U.S. tariffs and quotas, then the U.S. would be far better off by eliminating these artificial trade barriers than it would be by encouraging exports. If foreign tariffs and quotas are the source of suboptimal trade, then again the preferred route would be to convince foreigners to reduce their trade barriers. In this case, export promotion activities would actually be contrary to U.S. interests. Here, export promotion in the face of foreign tariffs is effectively equivalent to allowing foreign governments to tax U.S. residents.

Nonetheless, there is little doubt that the activities of the Export-Import Bank stimulate exports. The critical issue is, Why do we want more exports?

While academics and others can always work out conditions under which a specific policy is justified, it is far from clear to me that, in the context of the issue today, trade is below what it should be. It is even less obvious that, if trade were deemed as suboptimal, the activities of the Export-Import Bank would have a beneficial role to play in expanding trade. The very indirectness of the Bank's activities belies its ability to subsidize trade efficiently.

A country, just like an individual, produces in order to consume. On a countrywide basis, the difference between production and consumption is the trade balance. On an individual level, this difference is the increase in the individual's total savings.

From the general standpoint of national policies and priorities, I see no reason why one should wish to either encourage or discourage trade balance increases or decreases. Imports are the entire reason for exports, just as consumption is the entire reason for working. As George Shultz pointed out some time ago, we could always improve our net exports substantially if we only gave away our products. Clearly, such a policy is not in the U.S. self-interest. It is equally as obvious that prohibiting exports would not be in the U.S. self-interest.

Even if we were to conclude that, at the present time, improvements in the trade balance were warranted, I do not believe that the activities of the Export-Import Bank would, or could, be of much, if any, use in achieving this objective.

There is no question in my mind that the activities of the Export-Import Bank contribute to greater total exports. One debate is currently focused on just how large that effect is. I, personally, have not seen any study which adequately describes even the general order of magnitude of the Export-Import Bank's effects. Regardless of the actual magnitude of the effect on total exports, there can be no presumption whatsoever as to whether the program affects the trade balance.

As stated earlier, the sole reason for exports is to provide the wherewithal for imports. As such, export expansion programs are analogous to import expansion programs. This symmetry in the Economics literature is referred to as Lerner's Symmetry Theorem. Therefore, unless there is substantially more information available, an increase in exports would be roughly matched by an increase in imports. The trade balance effects would, therefore, be indeterminate if there are any at all. Definitive demonstrations of increases in exports as a result of the activities of the Export-Import Bank have no bearing whatsoever on the overall trade balance effects.

As a result, the focus of attention should be on whether we wish to subsidize those products which can be traded. Why do we choose these products for special treatment and not others?

The aggregate employment effects and the balance of payments effects of the activities of the Export-Import Bank are merely an extension of the trade balance effects. Again, there is no way of demonstrating an aggregate employment effect of Export-Import Bank activities. While clearly there will be increases in the employment in the export industries which are encouraged, there will also be the reduction in the employment in the import substitute industries. These two effects will roughly offset each other.

Again the question to address is, Why should we treat workers in the export industry to a subsidy at the expense of workers in the import substitute industry?

Just as export promotional activities have little or no effect on the trade balance, they also have minimal, if any, effect on the balance of payments. The balance of payments of a country is primarily a consequence of monetary phenomena which the Export-Import Bank does not influence. Virtually the entire offset to increased exports is increased imports. The capital account, as well as the overall balance of payments is unaffected.

One argument that could make sense under the correct circumstances is that there are specific imperfections in the long-term financing market for exports. To my knowledge, however, these "correct circumstances" are by no means self-evident. Why one should choose export financing as opposed to intra-U.S. trade financing is far from clear. Likewise, I know of no study that shows exceptional burden being placed on exporters.

As a final point, if the imperfections argument were used, there is no reason ever to charge anything other than competitive market rates. Below-market rates have no place in this analysis.

In total, then, I do not find the Export-Import Bank's activities justified on economic grounds. Irrespective of which rationale one uses to support an arguemnt for the activities of the Export-Import Bank, I, personally, do not believe that they are up to the job of fulfilling the objectives.

In addition to my view that they cannot accomplish the stated objectives, the Export-Import Bank is expensive.

Viewing the activity levels of the Export-Import Bank from a budget standpoint, one sees that in FY 1973 the activity level was at $8.5 billion. In 1974, that number was $9.1 billion. The budgeted number for 1975 is a little over $13½ billion.

If we were to use a consistent set of accounts along the unified budget line and include the Export-Import Bank in the budget (as it used to be and as it is currently scheduled to be in 1977), we would find that in 1973 the Export-Import Bank had contributed about $½ billion to total outlays, while in 1974, they contributed about $1.2 billion to total outlays. The budget estimate for 1975 is somewhere along the lines of $1½ billion. While there are agencies and Departments that have much larger effects on outlays, it is nonetheless true that these outlays reflect a very large amount of resources going through Export-Import Bank activities.

It is especially impressive to me to see the precipitous increase in the total activity levels of the Export-Import Banks' authorizations. In 1969, for example, they were at about $2.4 billion; 1970, about $4.0 billion; 1971, $5.4 billion; 1972, at $7.2 billion; and 1973 at about $8.5 billion. The growth in these activity levels mirrors the overall problem in the U.S. budget.

Therefore, not only do I believe that the Export-Import Bank does little good, I also believe that the Export-Import Bank is quite expensive. On a cost-benefit analysis, I see little reason for continuing the support of the Export-Import Bank.

Prior to moving on and discussing the direct issue that concerns us here, I would like to mention a few additional points. First, the Export-Import Bank is often justified by stating that other countries do the same or even more than we do. Such logic is totally inappropriate. If foreigners wish to throw away their money, why should it then be incumbent on the United States to throw some away too? Foreign export subsidies are no more efficacious than are ours. And putting two of them together make a doubly ineffectual program, only at twice the price.

Another point often mentioned by the Export-Import Bank is that it pays the Treasury a dividend and accumulates reserves and, as such, can be justified on revenue grounds.

Again, the logic of this point is just plain wrong. As pointed out in a letter to *The Washington Post* on July 24, 1974, Representative Reuss delineates the costs of the overall Export-Import Bank activity level. The basic point is whether the Export-Import Bank funds are used in the most efficient manner with regard to raising revenue. Basically, by lending at below-market rates, the Export-Import Bank, in fact, costs the taxpayer income he could have otherwise earned. Without going through the specifics, I would like to quote directly from Representative Reuss' letter on Export-Import Banks' privileges:

> Eximbank Chairman William S. Casey, in this column (July 12), attempts to justify Exim's massive volume of interest-subsidized loans by citing "the Bank's record of operating profitably and distributing $856 million in dividends to the Treasury."
>
> The fact of the matter is that Exim is an extremely expensive deal for the taxpayer, as a result of five thinly disguised special advantages. First, it has an original capital investment of $1 billion in taxpayer funds on which it pays a dividend of only five per cent to the taxpayer each year. Second, it has retained over the years $1.5 billion in earnings, also the taxpayers' money, which is relends without paying interest or dividends. Indeed, Mr. Casey's grandiose millions notwithstanding, Eximbank's total annual dividend payments amount to less than two per cent of its capital stock. Third, unlike commercial banks, Exim is backed by the full faith and credit of the United States Treasury, and can borrow at a cost lower than that of commercial banks. Fourth, Eximbank can borrow short-term funds from the Treasury at less than the Treasury rate—in other words, at a concessional rate subsidized by the U.S. taxpayer. Finally, Eximbank debentures, sold through brokerage houses on Wall Street, and elsewhere, are "qualified export assets" under the DISC statute. Accordingly certain companies can defer taxes on 50 per cent of the interest proceeds from Exim debentures. Given such special treatment, the Eximbank could hardly fail to show a "profit."

Moving on to the issue of atomic energy, I find the arguments in favor of further Export-Import Bank activities in this area even more deficient than they are in general. In the first place, nuclear fuel and technology and equipment are not the same as any other set of goods. They have wide political, as well as military, ramifications. Trade in these products deserves careful and close Congressional scrutiny.

While I know very little about the specifics of nuclear technology, the recent multinational political activities in this area clearly demonstrate that it is not viewed in the same light as, say, furniture exports. Export-Import Bank activities in this area have been quite large—some $272 million in disbursements for nuclear power equipment in 1974.

Government interventions in the trade area rarely have rational justification on economic grounds. The one exception to a total hands-off attitude is when the product being exported has significant political or military ramifications outside of its economic implications. In such cases, direct Government responses to the trade in this product are not only justifiable, they are to be preferred. It seems to me quite reasonable that nuclear fuel, technology, and equipment would fall into this category. As such, I feel it is quite appropriate that Congress would see fit to involve itself in all aspects relating to the export of this product.

If, for example, the product were deemed to have potentially damaging political or military consequences on the United States, then it should not be treated like any other export good. In such a case, export subsidies would do double damages. First, they cost in economic terms, and second, they cost in either political or military terms, or both.

Mr. Zablocki. Thank you very much, Mr. Laffer You are both associate professor of business economics, Graduate School of Business, University of Chicago and consultant to the Secretary of the Treasury. I presume you are now speaking in your private capacity?

Mr. Laffer. Yes, sir.

Mr. Zablocki. Your paper was therefore not cleared by the Treasury.

Mr. Laffer. No, it was not cleared by the Treasury.

Mr. Zablocki. It is not our policy to enter into debate between our witnesses. But your feelings are opposite. I would like to ask Mr. Minikes a question. On page 15 of your statement you take the position that the Bank is essentially unqualified to make complex judgments on the question of nuclear proliferation. Yet on page 13 you stress the rather unqualified view that the proposed House Concurrent Resolution 371 would not be in the best interest on the United States. Isn't there something of a conflict between these two statements?

CONFLICTING STATEMENTS AIRED

Mr. Minikes. Mr. Chairman, we feel there isn't for the reason that on page 15 the statement really addresses the question of our ability to make a judgment on a particular export, including, for example, what the various criteria should be to determine whether the question of proliferation or other such problems are a factor in the case. Whereas the other statement simply points out our belief that this type of a resolution would serve as a message to a potential purchaser that there is some uncertainty about the willingness of the United States to provide or facilitate the export of such plants and equipment.

Mr. Zablocki. A very fine differentiation. We will accept it. Does the Import-Export Bank explicitly consider any of the political factors that attach themselves to these nuclear exports? For example, do you consider how such exports may be used to help put a country in a position to own and control separated or unseparated plutonium or highly enriched uranium? Do you take these matters into consideration before making the loan?

Mr. Minikes. Mr. Chairman, when you say "political considerations" do you mean those specific——

Mr. Zablocki. Political factors that attach themselves to these nuclear decisions.

Mr. Minikes. We do not make those judgments, Mr. Chairman. That is why we refer those cases to the State Department and the Backstopping Committee, of which the Arms Control and Disarmament Agency is a member.

CONSIDERING POLICAL FACTORS

Mr. ZABLOCKI. Mr. Laffer, do you think Eximbank should explicitly consider political factors before making decisions?

Mr. LAFFER. To the extent that you wish to either subsidize or tax exports clearly you would want to have some sort of consideration along the lines of political or military lines. I see no other reasons why one would specifically either subsidize or tax trade as opposed to a product which may or may not be traded unless it had political and military ramifications.

This is the classic case of what we call trade distortion. When you have trade distortion it is when you would want to have either subsidies or taxes on trade. But then only when you have a pure trade distortion.

Otherwise if you have a production distortion you want a production tax or subsidy. If you have a consumption distortion you want a consumption tax or subsidy. Only in the case of a trade distortion do you want a trade tax or subsidy.

Mr. ZABLOCKI. In your observation or study of the Eximbank do you think they are equipped and able to take political considerations into account?

Mr. LAFFER. I am not qualified to judge whether they are able to take into account political considerations.

Mr. ZABLOCKI. But if you expect them to take into account political considerations how would they be able to unless they are so equipped?

Mr. LAFFER. I think they should be fully prepared, to have the expertise.

BANK PREPARED TO MAKE INDEPENDENT JUDGMENTS

Mr. ZABLOCKI. Mr. Minikes, do you believe that the Eximbank is not prepared to make such judgments on its own but has to refer to the State Department and other agencies of government?

Mr. MINIKES. Mr. Chairman, I am a little unclear about the distinction. If you are talking about technical evaluations, or about political evaluations——

Mr. ZABLOCKI. I think a combination of both.

Mr. MINIKES. The Bank acts in conformance to U.S. Government foreign policy on the political front.

On the technical side we do not have the capability in terms of manpower to make a technical evaluation in the areas which are of concern to you here. Other agencies of the Government do. I can see no reason why the Bank should expand its staff in order to make those judgments when others already possess that expertise.

Mr. ZABLOCKI. Going to a related matter, does the Export-Import Bank conduct independent analysis of such matters as the worldwide demand for electrical power, the substitution of alternative power sources, and so forth? Or do you again depend on other agencies for information in this area?

NO CAPABILITY OF INDEPENDENT ASSESSMENT

Mr. MINIKES. Your question, Mr. Chairman, puts the issue very squarely. I am unable to provide the type of answer that you may be seeking here. Although we don't have the capability to do an independent assessment, what we do do in the energy area, as Congress has mandated us to do is, to have an in-house capability to evaluate information which we can obtain from both within and without the Government on short supply situations with the staff economists in the Bank, we are able to do that much and we take that directive very seriously.

By adding to our staff experts in issues relating to proliferation problems we could assemble the best available information that should be brought to bear on a particular case and then make our own evaluation.

But right now on the proliferation issues in the nuclear area, we do work with and rely on the expertise of the experts in the Federal Government on these issues.

Mr. Zablocki. Thank you. Mr. Findley.

Mr. Findley. Thank you, Mr. Chairman.

Mr. Laffer, I was powerfully struck by your prepared statement on page 9, "Government interventions in the trade area rarely have rational justification on economic grounds." I say that because this morning all of us sat through a 2-hour session with Charles Robinson, Under Secretary of State, in which he made a defense of the Government intervention in the form of the grain agreement with the Soviet Union.

BANK ESTABLISHED FOR FACILITATING SOVIET TRADE

I was on the side of the critic, raising questions about the agreement, its effect upon our position in trade matters, and the dangers of Government intervention.

As I understand the history of Eximbank, it was created for only one purpose, and that was to facilitate trade with the Soviet Union. It was at a time when we established diplomatic relations with the Soviet Union. In dealing with that society, we saw no way we could do business with them in the absence of a Government financial institution. Am I correct on that?

Mr. Minikes. That was one of the principle purposes, Mr. Findley, going back to the original charter of the organization in 1934. Of course, in 1945, Congress reenacted and revised some of the earlier statutory provisions. We are now operating under the 1945 charter which had a broader purpose than the one to which you refer.

Mr. Findley. Are we now guaranteeing loans or providing direct financing to the Soviet Union?

Mr. Minikes. That is a technical question. Let me put it this way. We have not authorized any credits, guarantees, or any other financial assistance for exports to the Soviet Union since last year because we are prohibited from doing so at the present time under provisions of the Trade Act. However, we are still making disbursements under loans which were authorized prior to enactment of last year's legislative restrictions.

PURPOSE OF BANK HAS CHANGED

Mr. Findley. It is one of the curiosities of history that Exim is not now fulfilling the single purpose for which it was created.

Mr. **Minikes.** Originally. Although now I think it has a slightly different purpose, a much broader purpose.

Mr. **Findley.** You cite the need to provide loans beyond the 5-year limit that the banks like to establish. If Eximbank did not exist, there is a possibility, I assume, that financial institutions would review the present limitations. They can establish that limit because of the existence of the convenience in the institution of Eximbank. Am I correct?

Mr. **Minikes.** No; we don't believe that to be so, sir. We believe there are reasons why the commercial banks set that limit. They are varied. They have to do with their need to turn over funds on a more rapid basis and because of great uncertainties in the future. These are more uncertain times now than we have ever had in our country. So their desire and need is to limit their maturities to, say, 5 or 6 years. Our purpose is really to supplement that shortfall. We have not heard that we have been taking business away from the commercial banks.

EXIMBANK AIDS IN SALES ACQUISITIONS

Mr. **Findley.** Mr. Laffer, Mr. Minikes indicated that Eximbank helped to finance, I believe, 37 of the 47 nuclear plants that have been financed for foreign investors. If this Eximbank financing had not existed, what effect would you think this would have on the sales of those 37 plants? Would we have lost the business?

Mr. **Laffer.** The only way to judge is from theory. It seems to me that we would have lost some of the business; yes. Whenever we reduce the price of something through subsidy, we sell more of it. The question is whether we wanted the business, given what we were doing. As far as I can tell with regard to the financing of these activities, the market would have taken the place of Eximbank financing in most instances, and we would have had the long-term financing and long-term capital on a private basis.

Whenever you have an agency operating in the long-term area, of course, whether it competes directly on a 1-for-1 basis or not, as long as it gets a large amount of the business flowing through it, it leads to a diminution of private activity in this area. There is no question that it does that.

There is also very little doubt in my mind that at least we would have made the terms less desirable and we probably would not have sold 37. The question is whether we want to. We can sell cars abroad at a dollar apiece if we were willing to subsidize $1,999 per car. Do we want to sell cars for a dollar apiece abroad? It is not clear to me at all that we want to subsidize this.

Mr. **Findley.** Do you have any way to estimate the amount of subsidy in these sales, say, in terms of percentage of gross business.

ESTIMATING AMOUNTS OF SUBSIDIES

Mr. **Laffer.** There are ways of doing this. From what I understand, studies have been done by the Office of Management and Budget. What they look at are the lending rates for the agency, and then they look at the market rates and try to figure out some sort of percentage subsidy on the loans, the guarantees.

It is difficult to do because with the guarantees, obviously a company would not take up a guarantee if they thought it was too expensive if they could get alternatives that were cheaper. Therefore, the only ones that will take up the guarantee are those that can't get comparable guarantees in the market. So you get the quote unquote "bad credit risks" going into Government guarantees and the good credit risks going into the private market. So you get a situation of basically subsidizing bad credit risks.

The work that I have seen shows a large subsidy last year and falling very precipitously in, I guess, the last 12 months. But the subsidy effect on Eximbank loans has gone down to a very small level. The reason for this is that market rates have tended to fall, while Eximbank lending rates have tended to rise. So the subsidy effect in the past 12 months has gone down quite substantially. A year ago it was a very high rate from what I understand.

EXIMBANK STRENGTHENS ATOMIC ENERGY INDUSTRY

Mr. **Findley.** Is it your contention, Mr. Minikes, that our atomic energy industry would be weaker today had it not been for Eximbank financing:

Mr. **Minikes.** Very definitely so.

Mr. **Findley.** Do you have any way to measure that? Do you have any estimate you could give to illustrate your perception?

Mr. **Minikes.** I think you could run the gamut here from the obvious spreading of overheads costs, to the number of plants which went into the export market vis-a-vis the domestic demand and the benefits derived from those sales. Beyond that, it is difficult to measure the actual impact because you have to guess on what business you would have gotten and what you would have lost if Eximbank support were not available. You don't really know the answer to that until you lose the business.

We do have cases in the Bank—in fact, we had one very recently—where a country sought desperately for a couple of years to obtain sufficient private market financing to purchase a nuclear powerplant and was unable to do so. That is a recent example. There have been numerous others.

Mr. **Findley.** Do you have any comment on that?

DIRECT SUBSIDY SEEN AS PREFERABLE

Mr. **Laffer.** It seems to me it would be far preferable to use a direct subsidy for domestic production than using an export subsidy. If you have an industry problem, what matter does it make whether they are sold to foreigners or domestics? What you want to do is subsidize the production of the product, not using export subsidies in this case. Export subsidies are a very inefficient way of subsidizing an industry. If you want to subsidize an industry, why not subsidize it directly, if that is the target?

Economies of scale and production come about from a production distortion. To cure a production distortion, you don't want to use a trade cure by subsidizing exports. You want to use a production subsidy directly. Again, it is an inefficient way of subsidizing an industry.

You are wasting a lot of what you could do with a direct subsidy to the industry.

Mr. FINDLEY. Has Eximbank financed imports?

Mr. MINIKES. There have been only a couple of occasions, sir, when we have; none recently.

Mr. FINDLEY. Do you have applications for such financing?

Mr. MINIKES. No, sir.

Mr. FINDLEY. Mr. Chairman, I have several questions I would like to leave with the witnesses for answering in the record.[1]

Mr. ZABLOCKI. Very good.

Do you have anything further?

Mr. FINDLEY. No.

Mr. ZABLOCKI. Mr. Laffer, you have stated that in reviewing nuclear export applications under some circumstances, particularly when political considerations enter into it, that it would be desirable to take such considerations into account in the area of nuclear reactors. I understand we have certain requirements that have to be met. This, of course, is a political consideration. In your opinion, would it not be preferable to have a subsidy to sell a U.S. reactor rather than a French or Canadian reactor to India where there is this additional plus for the best interest of the entire world in an area that is so highly volatile?

Mr. LAFFER. If in fact the export of a nuclear reactor from France to India would lead to a third world war, there is no question I would do all I could to prohibit that export.

Mr. ZABLOCKI. Even if it didn't lead to a third world war, just war between Pakistan and India.

EXAMPLE OF TRADE DISTORTION

Mr. LAFFER. That is plenty. I was just using the argument in the extreme. I don't want to get the example too close to reality. I can think of reasons why we would want to subsidize export to a place if by subsidizing those exports we were able to control the use of nuclear energy. No question, this is a trade distortion. Only in this case the trade distortion comes about from us gaining worldwide benefits by making sure we export more than we would via the free market. I would think in your example we would want to subsidize the export of the product to India.

Trade distortions can come about in two ways. One is the export of products helps world welfare. The other way is when the export of a product hurts world welfare. I am not qualified to judge whether our exports of nuclear power and plant help or hurt U.S. interests in the world economy. But you would want to either subsidize exports or tax exports. For example, right at the end of World War II, I would not like to have seen the United States export nuclear weapons to Russia even if they paid the full price. I think we should prohibit trade in those products for military reasons. In the case of your Indian example, I think we would want to subsidize the export of nuclear plant so the French would not get into that market.

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[1] For question from and responses to the subcommittee see p. 124.

DISC AND NUCLEAR ARRANGEMENTS

Mr. ZABLOCKI. I am not sure that there are American subsidiary companies in foreign countries that would enter into the exporting of nuclear reactors. As you gentlemen know, DISC, the Domestic International Sales Corporations, are subsidiaries of American corporations formed solely for the purpose of export. It is our understanding that they are given special allowances for deferring taxes on profit. Do you gentlemen know whether nuclear exports are made in these arrangements?

Mr. LAFFER. I don't know.

Mr. MINIKES. I do not know.

Mr. ZABLOCKI. Mr. Minikes, is it not true that the so-called foreign competition that Eximbank is so anxious to offset is in reality equipment provided by those foreign suppliers under American licenses? Does the left hand knoweth what the right hand doeth?

Mr. MINIKES. That in fact is sometimes true. Of course, the French operate in part under licenses. There are also cases where in order to obtain more financing than the Eximbank provides on a U.S. order, the U.S. corporation will sometimes source the order from their own subsidiaries overseas in order to effect a foreign sale.

Mr. ZABLOCKI. Would you gentlemen advise the subcommittee and give your opinions as to my former question if you study the question about DISC and advise us on that point for the record, please?

[Mr. Minikes supplied the following information to the subcommittee:]

The Export-Import Bank has been advised by the General Electric Co. and Westinghouse Electric Corp., the two principal U.S. suppliers selling nuclear powerplants abroad with Eximbank financing, that they have not sold any nuclear powerplants through a DISC.

Mr. ZABLOCKI. If I may come back, Mr. Minikes, to the issue we were talking about earlier—namely, that of Eximbank conducting analyses of various types—and you did state that the State Department and other agencies performed political analyses and so on.

CONGRESS HAS SOLE VETO POWER OVER BANK

My question is: Does State or any other agency who perform the political analyses have a veto authority over a loan which Exim otherwise would want to make? If you depend on their opinion for the political impact, what further impact does State or any other agency make in your analysis of a loan?

Mr. MINIKES. Mr. Chairman, the Bank is an independent agency. No agency has a veto power over us other than the U.S. Congress.

Mr. ZABLOCKI. What then is the point of having the other agencies perform the political analyses? What value is in it?

Mr. MINIKES. We operate in conformance to U.S. foreign policy.

Mr. ZABLOCKI. Can you provide for the record any instances where a political analysis has caused Eximbank to reverse or deter it from making a loan? Does one come to your mind at the moment?

Mr. MINIKES. None comes to mind at the moment. Again, the ultimate decision is made by the directors of the Bank, not by any other agency. But we certainly don't operate in a vacuum. We very much take into consideration views of other agencies both in the NPT context and in other areas.

BANK INVOLVED WITH SALES TO ISRAEL AND EGYPT?

Mr. **Zablocki**. The recent controversial offer of nuclear reactors to both Israel and Egypt, would Eximbank be involved in the loan? I understand you would be to those two countries.

Mr. **Minikes**. We are not, Mr. Chairman. As far as consultations with the Bank, there have been none to my knowledge.

Mr. **Zablocki**. Would other agencies make a political decision before a particular project would get to your shop?

Mr. **Minikes**. This is a difficult area. You often get spokesmen for the United States traveling throughout the world and——

Mr. **Zablocki**. Making promises.

Mr. **Minikes**. Making promises.

Mr. **Zablocki**. Getting carried away with the atmosphere.

Mr. **Minikes**. Whether the Bank would agree to handle financing in such instances would depend on the particular case involved.

Mr. **Zablocki**. Mr. Lagomarsino.

Mr. **Lagomarsino**. I have no questions.

Mr. **Zablocki**. We have questions which we would like to present to both of you gentlemen for reply to the record, if you would please.

Thank you, Mr. Minikes.

Thank you, Mr. Laffer. Thank you very much.

The subcommittee stands adjourned until 2 o'clock, Thursday afternoon, October 30, when our witnesses will be spokesmen for the International Atomic Energy Administration, the Energy Resource and Development Agency, and the Nuclear Regulatory Commission.

[Whereupon, at 4:40 p.m., the subcommittee adjourned, to reconvene at 2 p.m., Thursday, October 30, 1975.]

[The questions submitted by the subcommittee, together with the responses by Mr. Minikes, follow:]

Responses by Stephen N. Minikes to Questions Submitted by the Subcommittee

Question 1. On page 13 of your prepared statement you give an example of the credit terms offered by Germany to support its nuclear exports. In the Ex-Im's letter to the Speaker justifying the credit for sales of reactors to Spain, mention is also made of the aggressiveness of credit agencies in other countries. Have the terms offered by Ex-Im and its counterparts in other supplier countries always been comparable? We would appreciate it if you would provide us with a detailed comparison of terms over the years.

Answer. The three most important features of export financing support are: interest rates charged, the percentage of contract value financed, and the credit maturities extended. Prior to 1969, when Eximbank would finance 90 percent of contracts values at a fixed six percent for maturities up to 15 years, its competitive position, by and large, could not be equalled by its competitiors.

To provide U.S. exporters with competitive financial services, but at the same time to avoid competing with private capital, Eximbank, in 1969, adopted a participation financing program. Under this program, which is still operational today, Eximbank and private commercial banks share in the financing of export transactions, often equally. Thus, since 1969, Eximbank has been less competitive as to the percentage of contract values it will finance; several of the Bank's principal competitors continue to finance up to 85 percent of contract values.

However, the Bank has maintained its competitive edge regarding credit maturities.

The Bank is flexible and bases its maturity decisions primarily on each project's anticipated cash flow, while its principal counterparts generally set arbitrary maturity limits based on the wealth of the borrower's country. Eximbank's interest rate competitiveness has declined slowly since early 1974 due primarily to the fact that the Bank must operate as a self-sustaining institution. In contrast, each of the Bank's principal counterparts have access to and often receive appropriations of national government tax receipts to supplement their earnings.

The attached table illustrates the changes in export credit interest rates in the principal competing trading nations since December 1972. It should be noted that interest rates shown for the U.S. as of September 1975 may be reduced case-by-case by Eximbank if it is determined that U.S. exporters face meaningful foreign export financing competition.

A. INTEREST RATE DEVELOPMENTS[1]

[Percent per annum; quarter ending]

	December 1972	December 1973	June 1974	December 1974	March 1975	June 1975	September 1975
Export Credit Agency:[2]							
United States	6.0	6.0	7.0	8.0	8.0	8.0	8.9
France	6.5	6.5	6.7	6.7	7.5	7.5	7.5
Germany, Federal Republic	6.8	8.6	8.6	8.6	8.1	7.8	7.8
Italy	6.5	6.8	6.8	------------	8.8	8.0	8.0
United Kingdom	6.0	6.0	7.3	7.8	8.0	7.5	7.5
Japan	6.0	6.3	7.0	7.5	7.5	7.5	7.5
Blended export credit rate:[3]							
United States	7.1	7.8	9.0	10.7	8.5	8.9	9.5
France	7.7	7.3	7.5	7.5	8.2	8.2	8.2
Germany, Federal Republic	8.4	10.2	10.2	10.2	8.8	8.9	8.9
Italy	7.2	7.5	7.5	14.7	11.3	9.5	9.5
United Kingdom	7.1	7.1	8.4	8.5	9.2	9.2	9.2
Japan	6.2	7.2	7.9	8.6	9.0	8.4	8.4

[1] The attached table should be read together with the accompanying footnotes which provide a detailed explanation of the table and their significance.

[2] The midpoint of range or most commonly applied rate, excluding fees, in various official export credit support programs. The rates are those on direct credits in the United States and Japan, interest rate subsidies and refinancing support in the United Kingcom and Italy, and discount loans combined with direct loans in France and Germany. Mediocredito Centrale did not support Italian export credits during most of 1974 due to a lack of funds.

[3] Reflects the combined cost of export credit agency and private export credit in the United States, France, and Japan, the cost of officially supported private credit in the United Kingdom and Italy and the cost of credit from 2 public sources in Germany (AKA and KfW). All fees and the cost of required insurance are included.

Question 2. What other devices are used to aid nuclear exports in the other supplier countries?

Answer: In France and the United Kingdom, manufacturers of capital goods to be exported can obtain, for a small annual premium, protection against inflationary production cost increases. This gives them the significant advantage of being able to quote essentially fixed prices for capital equipment that may take several years to produce. The United States and many other trading nations continue to oppose inflation risk protection programs because they are little more than direct price subsidies offered under the guise of export credit insurance—subsidies in clear violation of international trading rules.

Exporters in France, Germany, and Japan, as well as other smaller trading nations, benefit from the availability of protection against exchange rate fluctuations. For a small annual premium that often entails a governmental subsidy, they are assured that they will not incur losses, on export transactions denominated in a currency other than their national currency, due to unfavorable changes in exchange rates.

Question 3. Do you undertake a detailed evaluation of the economic pros and cons of the nuclear activities in the recipient countries that we are supporting by such loans? If so, could you provide us with this material.

Answer. Eximbank does *not* undertake a detailed evaluation of the economic pros and cons in any country receiving Exim credits for U.S. nuclear plant exports. Any country's decision to go nuclear is usually the result of complex considerations relating to matters political, social, as well as economic—witness the post 1973 revival of U.S. nuclear interest. Since Exim is not privy to all these considerations—nor even to all aspects of the economic considerations—we confine ourselves strictly to ensuring a financially sound project and a creditworthy obligor/country.

Question 4. What are some of the alternative economic investments for these countries?

Answer. Eximbank analyzes the national power program to see if the amount of power entailed in any nuclear project is consistent with national energy needs. Eximbank also analyzes the utility's rate structure and financial strength to assure that the borrower can generate sufficient income to repay the debt. Eximbank does not, however, undertake to determine whether nuclear is the "most economical" means for a specific foreign utility to meet national power needs.

Question 5. Does the Export-Import Bank explicitly consider any of the political factors that attach themselves to these nuclear exports? Do you consider, for instance, how our activities may be used to help put a country in a position to own and control unseparated or separated plutonium or highly enriched uranium?

Answer. Eximbank does *not* explicitly consider any of the political factors that attach themselves to nuclear exports. Exim does not have, nor believe it should develop, the expertise to make judgments on such factors. Exim asks guidance on such matters from State, ERDA and all other relevant U.S. Government institutions for *every* nuclear case that comes before the Board.

Question 6. We would appreciate it if you would compare the financial arrangements made with the help of the U.S. government with those made by private institutions that do not have that help. Could you make a comparison of such things as (a) loan guarantees, (b) amortization periods, (c) interest rates, and (d) payability in dollars or in local currency.

Answer. Eximbank has assisted every U.S. nuclear plant export since the late 1960's and 37 of the 47 U.S. export projects. The other ten projects either were AID financed or were relatively small U.S.-content purchases by West European countries such as Switzerland. Eximbank has no knowledge of the financing arrangements made for these West European purchases.

Data is available, however, on a recent U.S. utility borrowing in domestic capital markets to finance power plant construction and a 1974 borrowing by a French utility from the European Investment Bank for nuclear construction.

	Exim-assisted [1]	U.S. utility [2]	European utility [3]
Rate to borrower (percent)	9.7	9.0	8.75
Amortization (years)	[4] 15	25	20

[1] Assumes 45 percent Exim credit at 9.5 percent and 45 percent Exim guarantee (for a fee of 1 percent) on private financing at average rate of 9.25 percent.

[2] Southern California Edison issue on Mar. 6, 1975, for $150,000,000.

[3] EIB press release March 2, 1974.

[4] Plus construction.

[Subsequently, Eximbank submitted the following comments on Mr. Laffer's testimony for inclusion in the record:]

EXIMBANK'S ADDITIONAL COMMENTS ON TESTIMONY OF PROFESSOR ARTHUR LAFFER SUBMITTED FOR THE RECORD

Mr. Laffer feels that export promotion is unnecessary, and in some instances may even be harmful to the economy. His criticism of Eximbank, which Mr. Laffer concedes is probably effective in its purpose of attaining a higher level of exports, is part of a larger argument against export promotion. The criticisms of the Bank are not based on an analysis of Eximbank's operations or of its effectiveness and efficiency as an institution but rather are based, instead, on the Bank's position as a government institution involved in export promotion.

Eximbank does not agree with Mr. Laffer's crucial assumptions that (1) export increases are perfectly matched by import increases, and (2) that the benefits of additional exports are exactly offset by the losses potentially implied by increased imports. However, the real issue is not whose theoretical view of world trade flows is more accurate. The real issue is that Eximbank is *not* in business to give exports an extra push denied other sectors of the economy; to push exports for exports sake. Rather, Eximbank is in business to ensure that the U.S. income and employment related to production whose price and quality attract foreign buyers should not be lost because the potential sale cannot obtain adequate financing in the private market.

The distinction between these two interpretations is crucial: The first has Eximbank stimulating exports beyond the level determined by "market" forces such as price and quality, while the latter has Eximbank enabling exports to attain the level which price and quality would determine. The Congressional mandate "to aid in financing and to facilitate exports", under which Eximbank operates is based on the fact that U.S. exports would be at suboptimal levels if the Federal Government did not provide assistance to the financing aspect of trade in this sector. This desire to reach an optimum level of production is the same as that which underlies the financing programs which the Federal Government provides to other sectors of the economy such as housing, agriculture, and transportation.

The reasons for the lack of adequate U.S. financing for particular exports can vary from case to case. However, three prominent obstacles continue to emerge in almost all cases: Size of the loan; maturity requirements; and the lender's perceptions of the risks involved.

Amount of Financing Required.—Because of legal and operational lending limits, commercial institutions frequently find it impossible to provide the amounts of financing needed for the many large projects constantly underway around the world. If Eximbank were not there to supplement private capital availability, many of these projects would face cancellation.

Maturity.—Capital goods sales usually require long-term financing. In the United States, these sales are funded by long-term investors such as insurance companies. However, tradition and law tend to greatly restrict the activity of these institutions in supporting U.S. capital goods exports. Financing U.S. capital goods exports falls, therefore, almost exclusively to the commercial banking system. Commercial banks, however, are extremely reluctant to extend maturities beyond 5 to 7 years. The resulting shortfall in the availability of long-term funds to support U.S. capital goods exports is perhaps the strongest and most widely accepted rationale for the existence of Eximbank.

Risk.—Commercial sources of credit traditionally assign a higher risk to export transactions than to equivalent domestic transactions. This higher "perceived" risk results in keeping many commercial institutions out of the export financing field altogether and frequently threatens to endanger the financing possibilities of other feasible and appropriate export transactions.

Mr. Laffer touches on these financial market imperfections, and says that he knows of no study that indicates an exceptional burden being placed on exporters in regard to financing. A February, 1975 study by OMB, "Interagency Report on U.S. Government Export Promotion Policies and Programs," sheds some light on this subject. For example, in a section on the gaps in long-term credit for export financing it states:

The reluctance of banks to provide long-term financing raises a problem for financing major capital equipment projects, which have long payback periods. . . . to the extent that adequate alternative sources of financing are not available, Eximbank loans in this area should help facilitate profitable export transactions and increase national income." (p. III–5)

The reasonableness of Eximbank acting to overcome demonstrable private market imperfections is recognized in this OMB report and is supported by other unpublished interagency studies of the operations of private financial institutions.

Mr. Laffer points out that "below-market rates have no place" in the market-imperfections rationale presented above. However, Eximbank interest rate levels have generally been closer to market levels than any of the other official export financing institutions and today's schedule of Eximbank interest rates may already be so high as not to meet its legislative mandate to offer credit "at rates and on terms . . . available for the financing of exports from the principal countries whose exporters compete with U.S. exporters."

Eximbank attempts to implement the goals mandated by Congress of offering supplementary yet competitive financing by extending a range of rates which, when used in a flexible and responsive manner, enables Eximbank to offer competitive financing that entails very little inducement to prefer Eximbank over private sources. For example, U.S. short-term rates (prime, etc.) are in the 7% range; the long-term rates for good borrowers is 9–10%; and Eximbank's official competitor agencies are offering financial packages costing 7.5–8.0%. Eximbank's basic range of 8.25–9.5% closely parallels the range between private short- and long-term funds, while Eximbank's infrequent use of an 8.0% credit allows it to closely approximate the costs of foreign financial packages.

The rates and terms Eximbank offers may be "below-market" but they are not "give-away" rates. The OMB-computed theoretical subsidy ratio in Eximbank credits ($1.40 for every $100 loaned) is one of the lowest in all of the U.S. government's myriad financial assistance programs and far less than that implicit—or actual—in foreign programs. The real tax revenues generated by the additional corporate and individual income can be expected to more than offset the theoretical subsidy cost.

Most importantly, however, is the equity involved. The economic structure of the U.S. and the economic philosophy of all administrations over the past 40 years have explicitly recognized the need to maintain equity in the marketplace. To do otherwise would be to tell a U.S. manufacturer and his employees that the U.S. government is not prepared to use its resources *at no cost to the taxpayer* to provide financial assistance for his potential sales abroad equal to that received by his foreign competitors. Eximbank's activities are intended to create an environment in which comparative credit costs are less of a factor in deciding the award of an international contract; rather, prices, quality and delivery operate to determine the manufacturer and country of origin. Hence, Eximbank's provision of competitive financing enables the "market" to allocate resources in an efficient, equitable manner.

In sum, Eximbank extends credits basically to ensure that U.S. exports attain their market-determined optimum levels. This objective is consistent with the Federal Government's long-standing and widely-applied practice of correcting imperfections in financing markets. The rates at which Eximbank extends its credits reflect, among other things, a desire to enable U.S. exporters to compete equitably in world markets. This practice is consistent with our Government's commitment to provide its citizens with equal access to economic opportunities.

[Eximbank's comments were forwarded to Mr. Laffer, and he submitted the following remarks:]

RESPONSE TO THE EXIMBANK'S COMMENTS BY ARTHUR B. LAFFER

1. I do feel that the Government should reconsider the wisdom of all export promotion schemes. I also feel, despite the Eximbank comments, that an efficient export promotion program would not include an Export Import Bank. There are numerous ways to subsidize exports, and the techniques used by the Eximbank would not rank high from an efficiency standpoint. Eximbank costs the taxpayer more per dollar of additional exports than would a number of alternative methods.

2. The Eximbank comments argue that Exim's function is to restore equity—that foreign export subsidies dictate U.S. export subsidies on equity grounds. The point missed here is that U.S. subsidies to U.S. exporters impose an undue burden on U.S. taxpayers and on U.S. producers of import-substitute goods. Exim subsidies do not offset foreign export subsidies.

3. The Eximbank comments make note of three market failures to justify the need to subsidize export financing. In a recent study, written at the U.S. Treasury Department, these types of market failure arguments are correctly debunked. In his paper "Alleged Market Failures in Financing U.S. Exports," Joseph Burns of the OASIA Research Staff analyzes exactly the arguments made in Exim's comments on my testimony, and finds them unconvincing.[1]

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[1] Discussion paper appears on p. 364 of appendix.

NUCLEAR PROLIFERATION: FUTURE U.S. FOREIGN POLICY IMPLICATIONS

THURSDAY, OCTOBER 30, 1975

House of Representatives,
Committee on International Relations,
Subcommittee on International
Security and Scientific Affairs,
Washington, D.C.

The subcommittee met at 2:15 p.m. in room H–236, the Capitol, Hon. Clement J. Zablocki (chairman of the subcommittee) presiding.

Mr. Zablocki. The subcommittee will please come to order.

This is the fourth in the subcommittee series of hearings on the subject of nuclear proliferation. In keeping with our objective of obtaining a complete and well-rounded picture of this many-faceted issue, we have with us today representatives of three different regulatory agencies. Each has been asked to address the general question of proliferation from the perspective of its designated function. In addition, we look forward to receiving specific comments and suggestions regarding House Concurrent Resolution 371.

Our witnesses this afternoon are the Honorable Gerald F. Tape, U.S. Representative to the International Atomic Energy Agency, IAEA; Mr. Nelson F. Sievering, Jr., Assistant Administrator for International Affairs of the Energy Research and Development Administration, ERDA; and Mr. Richard Kennedy, Commissioner of the Nuclear Regulatory Agency.

We would appreciate a brief 10-minute verbal summary of your testimony. Your complete statements will, of course, appear in their entirety in the hearing record.

Ambassador Tape, if you will proceed, sir.

STATEMENT OF HON. GERALD F. TAPE, U.S. REPRESENTATIVE TO THE INTERNATIONAL ATOMIC ENERGY AGENCY

Dr. Tape is a physicist and for eleven years was Deputy Director of the Brookhaven National Laboratory. Since 1962 he has been President of Associated Universities, Inc., which directs the operation of Brookhaven. He served as a member of the President's Science Advisory Committee, and is Chairman of the Defense Science Board.

Dr. Tape has been the U.S. Representative, with the rank of Ambassador, to the International Atomic Energy Agency (IAEA) since June 1973. He resides in Washington and travels to Vienna for key Agency meetings.

Ambassador Tape. Thank you, Mr. Chairman. I am pleased to be able to discuss the House Concurrent Resolution 371 with you today, Mr. Chairman. I will try to hit some of the high spots in my testimony as you have requested.

Let me first say that in light of my particular responsibilities, I will try to address principally those matters which relate to the International Atomic Energy Agency. This means that I will really talk to the operative paragraphs 3 and 4 of House Concurrent Resolution 371 and will have nothing to say about the first two paragraphs which are really outside my field.

In my testimony, I do provide for you some of the background of the Agency itself. I think most of you know that it was initiated by President Eisenhower in his address to the United Nations in 1953 and the Agency finally came into being in 1957.

It is in the United Nations family. It is the Agency under the aegis of the United Nations which is responsible for international activities concerned with the peaceable uses of atomic energy. It is located in Vienna, Austria.

OBJECTIVES OF IAEA

Its objectives are to,

> * * * seek to accelerate and enlarge the contribution of atomic energy to peace, health, and prosperity throughout the world * * *;

and

> * * * ensure, so far as it is able, that assistance provided by it or at its request or under its supervision and control is not used in such a way as to further any military purpose.

The United States shares these objectives and throughout the years we have done our utmost to cooperate with the Agency and to support the Agency to see to it that these are indeed carried forward.

Mr. Chairman, I would like to emphasize that within our own Government, although the cognizant support of the Agency is through the Department of State, it requires the full cooperation of other agencies such as the Arms Control and Disarmament Agency, Energy Research and Development Administration, and the Nuclear Regulatory Commission, as the principals.

Without their very effective support, we would not have the progress which has been made to date.

I might note for you that this is an Agency having a strong technical mission, both in its work in supporting developments throughout the world and in its more regulatory type work related to safeguards and safety.

This technical focus has been a strength of the Agency because it has permitted members to submerge their ideological and political differences and to fairly address the problems before them, and these are problems having a direct impact on the health, welfare, and standards of living of their citizens. Thus, we can come to grips with the problems in a very straightforward manner.

HOW SUPPORT IS RECEIVED

U.S. support is both through a regularly assessed budget and through a voluntary budget. The voluntary budget is of great importance to members of the Agency because it provides them with mechanisms of working through the Agency to the developing nations and provides a balanced program in which we can, on the one hand, support matters of interest to the developed world, matters of interest to the developing world, and safeguards in the control of the nuclear materials and facilities engaged therein.

I will not go into the general organization of the Agency, Mr. Chairman. I think, however, I should highlight here that the Board of Governors is the executive organ of the Agency. It does consist of 34 representatives of member nations, of which there are 109 at the present time, and this Board has very strong powers. It has the authority to carry out the functions of the Agency.

Its responsibilities are broad. It has very specific responsibilities in the areas of safeguards, which is the subject of interest to this committee. The Board approves every safeguards agreement between the Agency and the country with whom that agreement is negotiated, and the designation of inspectors by the Agency is done name by name by the Board.

ROLE OF THE BOARD OF GOVERNORS IN SAFEGUARDS AGREEMENTS

In this connection, I might note for you that also, in the event of noncompliance with the provisions of the safeguards agreements, the Board is called up to report such noncompliance to member states and to the Security Council and to the General Assembly of the United Nations. If the state fails to take corrective steps within a reasonable time, the Board may withdraw or terminate any assistance given to that state by the Agency. I might also add that this then means that, if the Agency is unable to carry out the provisions of the safeguards agreement, it would find itself dutybound to terminate that agreement, and this then would be put back on the supplier nations who would no longer be in a position to supply for lack of safeguards agreements. So there is a mechanism of sanctions.

Let me add that there has not yet been in the Agency's existence a case where the Board has had to take these procedures.

Again, referring to the Board, I should state that there are some 9 of the 34 seats filled by member states who are designated most advanced in the nuclear technology and the production of source materials. By virtue of that particular designation, the United States has always occupied one of the seats.

The Secretariat of the Agency is the working body of that Agency, headed by a Director General, Dr. Eklund. The staff numbers something over 1,200 at the present time. As you can understand with most international bodies, the employees of the Agency have wide geographic and state distribution.

We feel that it is one of our most important tasks to see to it that we have good U.S. people who will fill posts in the Agency, and we have between 18 and 20 percent of these posts normally filled by U.S. citizens.

U.S. RELATIONSHIP WITH IAEA IS SOURCE OF STRENGTH

With respect to our own U.S. relationship with the Agency, we have in Vienna a U.S. mission; it is headed by a resident representative. When I am in Vienna for meetings of the Board, the General Conference, and other special meetings, I then become the head. In the intervening time, the resident representative is the head.

There are six staff professionals at the present time. They are generally divided between what I would call career foreign service officers and experts in nuclear energy and nuclear nonproliferation matters.

This, if I may say so, has been an effective U.S. mission through the years. It has long been recognized by the Agency as a great source of strength. Each time the Director General visits us in this country, he speaks strongly to the effective work we have done. It is the U.S. leadership, I think, which has been so necessary for the work of the Agency—consultations with other missions, liaison back home, and working with the Agency directly.

Safeguards, as I have said before, is one of the most important aspects of the Agency's work. We here are going to spend more time talking about safeguards today because of its interrelationship with materials control and nonproliferation.

ELEMENTS OF SAFEGUARDS SYSTEM OUTLINED

There are several elements to a safeguards system. As I noted earlier, it requires an agreement between the Agency and the government concerned, and it doesn't matter whether the government is a member of the Agency or not. It is a function that is done for all parties that may wish to engage in nuclear affairs. The Agency then examines the design information of those nuclear facilities to be included, then through a system of records and reporting receives reports from the state, and finally, carries out inspections by Agency inspectors. There is an independent verification by the Agency of the work and the safeguards done by the nation.

As you can see, it is a two-tier type system. The nation itself must have a national system of safeguards with independent verification on top of that by the Agency. The Agency does not do the safeguarding for the nation itself; it builds on the state's own work.

Let me say, to avoid confusion, that we in this country have tended to expand the word "safeguards" in recent years to include physical protection of nuclear materials and in some cases even have expanded it to refer to the prevention of sabotage of nuclear facilities or nuclear material. Although the IAEA is concerned about these latter issues, it does not have the authority to inject iself directly into those areas. Its authority is restricted to the materials control and accountancy surveillance type of work, although it is concerned. It has brought out guidance for nations and most recently a new set of guiding principles has been issued on physical protection. Agency authority is confined to that included under the safeguards agreements, and those address the independent verification of the country's undertaking that material and equipment will not be diverted to military use.

DECLARATIONS AT REVIEW CONFERENCE REFLECT AGENCY'S WORK

Mr. Chairman, in the interest of time, I was going to note for you certain items in the declaration from the NPT review conference. I expect that others may bring these to your attention or already have, but let me just touch on a couple because they do bear on the Agency's work.

One of these pertains to the subject of this hearing today and the Agency. I will quote: "[T]he considered view of many Parties to the Treaty"—and this is included in the NPT Review Conference Declaration—"that the safeguards required under Article III.2 of the NPT should extend to all peaceful nuclear activities in importing States; * * *."

I think that certainly is a basis of some of your own considerations in House Concurrent Resolution 371.

With regard to multinational nuclear fuel cycle centers—and this is the thrust operative paragraph 4—

> Regional or multinational nuclear fuel cycle centres may be an advantageous way to satisfy, safely and economically, the needs of many States in the course of initiating or expanding nuclear power programs, while at the same time facilitating physical protection and the application of IAEA safeguards, and contributing to the goals of the Treaty.

STUDY OF REGIONAL NUCLEAR FUEL CYCLE CENTER UNDERWAY

I would like to note here that IAEA does have a regional nuclear fuel cycle center study underway. Because we are talking about regional and multinational or international activities, it was thought that one of the major contributions an international body like the IAEA could make would be to marshal resources to undertake that study. That is now underway.

Secretary Kissinger in his U.N. General Assembly speech also emphasized the need to move strongly ahead in this particular direction.

I might say, Mr. Chairman, that this is going to take a lot of effort. The Agency itself does not have resident in-house, the kind of staff competence necessary to do a complete study, and so it will be calling on many nations who do have the expertise to contribute both financially and in the provision of experts.

Now, there were other matters in the NPT Review Conference final declaration, but in the interest of time will skip over those and come directly to the two points in your resolution about which I would like to say a few more words.

The first operative paragraph 3 that has to do with the placement of the complete nuclear fuel cycle or, let us say, all nuclear facilities under safeguards within a country, either by participation in the NPT as a party or by unilateral submission of all such facilities to Agency safeguards.

APPLICATION OF A COMMON SYSTEM

Certainly, I think there is no question that a world in which we had all of the nonnuclear weapon states submitting their entire nuclear programs to safeguards either by virtue of being a party or by unilateral submission would be a worthy objective, and there is no question but what there are many advantages. I think it is easy to see that most of them arise from the application of a common system. For example, safeguards are removed from the marketplace—suppliers and customers understand and respect the common standards; all material in the country is under one system of control, accountability, and inspection. Finally, and any time we have greater uniformity in effecting agreements and in implementing agreements, there are certainly benefits to be achieved.

This is certainly a most desirable goal. I would like to note, however, that in the fourth operative paragraph, you are addressing the question of regional fuel cycle centers, and that tends to add a restriction, if I may call it that, that would not be called for under the NPT or a unilateral submission.

U.S. SHOULD BE FLEXIBLE IN ACCOMPLISHING OUR GOAL

Returning to operative paragraph 3, I note that you have included the caveat: "* * * if all other major nuclear suppliers agree to a similar halt on such transfers." I agree with you that is necessary that this be approached on a uniform basis by all suppliers. But even here I think we can expect that different suppliers and different recipient countries, when paired off by virtue of long standing relationships between countries either historical, political, or economic, will view their obligations in different ways; and these go beyond nuclear considerations. They are historical in most instances. As a result, I think one should be alert to the fact that there may be differences and that, while the overall mutual objective is still one of nonproliferation, we should never be so inflexible that in achieving the goal for the great majority of nations, we drive a small number of important states to the development of their own unsafeguarded nuclear capability.

In that connection, we also must not lose sight of the fact that no nation has an exclusive monopoly on either the technology or the materials; and this is truer today than it was 10, 15, 20 years ago.

With respect to operative paragraph 4, which has to do with the regional fuel cycle facilities, again I say the proposal has merit and it has appeal. I think, however, it is going to require a very major initiative and a significant investment of technology and money by the parties involved in such an undertaking.

Certainly, having centralized facilities in which we could store sensitive materials and provide safeguards and physical protection will minimize some of the sensitivities of that particular part of the fuel cycle. I expect there can be economies of scale, and I think that by pooling requirements of smaller nations, we certainly could better satisfy their needs than if each had to go his own way.

DIFFICULTIES NOT VIEWED AS INSURMOUNTABLE

There are some difficulties with this proposal; on the other hand, I don't consider them to be insurmountable. As noted earlier, we certainly must observe our obligations under the NPT and any conditions that would appear to extend beyond the treaty would have to be by mutual agreement.

I note that in the resolution you have said, "[t]he Congress urges an agreement," and this I interpret to mean a mutual agreement between the supplier and the customer. To be successful, this is going to call for extensive cooperation and consequently, I think, real initiative on the part of suppliers, starting with the technology transfer, construction, operation, and management, and may be even capital investment.

Mr. Chairman, really it would be easier for us in the United States today to mount a very strong, hard campaign for regional fuel cycle centers if we had some operating reprocessing plants under our belts. It is a more difficult situation given the state of our own experience and our own resources; however, I am not going to let that deter me. I think that studies such as those of the IAEA and others that have been undertaken will certainly help to identify the opportunities and the problems, and all of this will encourage international cooperation.

COOPERATION VITAL IN SUCCESS OF FUEL CYCLE PROGRAM

I think that one way we might really get into this is to start cooperative work soon, pick certain nations who could benefit by this regional facility approach and get going on the problem. It is in our interest to do so. I think agreement to proceed along the lines indicated would be much more readily achieved by having strong U.S. participation than by leaving it to others.

The one way we can be influential in this whole area is to be involved ourselves. If we walk away from it, we have no control.

Mr. Chairman, I may have taken a little longer, but I hope you will excuse me.

[The prepared statement of Ambassador Tape follows:]

PREPARED STATEMENT OF HON. GERALD F. TAPE

Mr. Chairman and Members of the Committee: I am pleased to appear before this Committee to discuss with you House Concurrent Resolutian 371. This Resolution addresses several important aspects of non-proliferation of nuclear weapons. It is my intention to address only those matters for which the International Atomic Energy Agency has a role or where its activities contribute to the nonproliferation of nuclear explosives. As a consequence, I shall not address the specific subjects of extension of the Vladivostok Accord to an arms reduction agreement or the adoption by all nuclear weapons states of a comprehensive test ban treaty prohibiting the testing of nuclear explosives. I shall address the subjects of transfers of nuclear fuel, technology and equipment under accepted international safeguards and the possible establishment of regional nuclear fuel cycle centers of a size sufficient to meet the needs of a number of cooperating nations. Before doing so, I would like briefly to provide some background on the International Atomic Energy Agency, its organization, its activities pertinent to the subjects under discussion, and the U.S. relationship to the Agency.

President Eisenhower, in his "Atoms for Peace" address to the 1953 General Assembly of the United Nations, urged the establishment of an international organization to "devise methods whereby . . . fissionable material would be allocated to use in the peaceful pursuits of mankind". Following several years of negotiation, the Statute of the International Atomic Energy Agency came into force and the Agency came into existence on July 29, 1957.

The International Atomic Energy Agency is an inter-governmental autonomous organization with headquarters in Vienna, Austria. It is related to the United Nations by the terms of an Agreement which recognizes it as "the agency under the aegis of the United Nations responsible for international activities concerned with the peaceful uses of atomic energy . . .". The objectives of the IAEA as specified in its Statute are to:

"Seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world . . ."

"Ensure, so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose".

The United States shares these basic objectives of the Agency. As such, we have a responsibility to participate actively in its policy and program formulation and implementation, to support strongly its activities in a variety of ways, and to make available qualified U.S. personnel for employment by the Agency.

The cognizant support is through the Department of State with the U.S. Mission to the IAEA in Vienna providing on the spot liaison and support. The extensive nature of the IAEA's program and our own governmental structure is such that we must have the effective participation, in addition to several bureaus in DOS, of ACDA, ERDA and NRC, to name the principals. Mr. Chairman, the United States support has been effective in great measure due to the excellent cooperation received from these agencies.

You will note the heavy technical emphasis of the Agency's work. This has been a strength of the Agency; it has permitted Members to submerge ideological and political differences in the interest of making progress on technical fronts that have a direct impact on the health, welfare, and standards of living of their citizens. They are appreciative of the assistance received from the Agency and through the Agency, though critical that it has, in their opinion, been insufficient.

In addition to the assessed contribution to the Agency's Regular Budget, all Members are urged to make annual voluntary contributions to the Agency, both for technical assistance to developing nations and for augmentation of the Agency's own program. The United States provides cash and in-kind assistance. The latter includes, for example, fellowships for study in the United States, U.S.-made scientific equipment, and the services of U.S. experts. We also provide for continuing active cooperation in the implementation of the Agency's programs through interchange of scientific and technical information and provision of experts.

The three main organs of the IAEA are:

1. *The General Conference* in which all Member States of the IAEA meet annually (approximately one week) to elect the Board of Governors, to elect new Member States, to review the work of the Agency and give guidance on future programs and to approve the annual budget. There are now 109 Member States.

2. *The Board of Governors*, the executive organ of the Agency, consists of 34 government representatives. The Board approves the program, submits the budget to the General Conference, approves all important agreements and decisions and generally carries out the functions of the IAEA subject to its responsibilities to the General Conference. The full Board normally meets four times a year; Committees of the Board meet at other times.

The IAEA Board of Governors is unique in the UN family by virtue of the unprecedented scope of its authority. The Statute gives the Board "authority to carry out the functions of the Agency". The Board appoints the Director General (subject to the approval of the General Conference), and submits the annual budget of the Agency to the General Conference, which can accept or reject it, but not amend it.

The Board has important responsibilities under the Statute in the field of Safeguards. It approves each Safeguards Agreement to which the Agency is a party, and the appointment of each Safeguards inspector. In the event of any non-compliance with the provisions of a Safeguards Agreement, the Board is called upon to report such non-compliance to Member States and to the Security Council and General Assembly of the United Nations. If the State fails to take corrective steps within a reasonable time, the Board may withdraw or terminate any assistance given to the State by the Agency. (There has never yet in the Agency's existence been a case where the Board was required to invoke these procedures.)

Nine of the 34 Board seats are filled by Members designated each year, for one-year terms, by the outgoing Board from those Members "most advanced in the technology of atomic energy including the production of source materials". In addition, the outgoing Board designates the Member most advanced in each of the Agency's geographic regions which do not include one of the above nine. The remaining 22 seats on the Board are filled by election by the General Conference for two-year terms, with specific provision for distribution of these seats among the eight geographic regions named in the Statute. The United States has always occupied one of the designated seats.

3. *The Secretariat* of the IAEA is headed by a Director General, Dr. Sigvard Eklund, and is organized into five Departments, four of which (Research and Isotopes, Technical Assistance and Publications, Technical Operations, and Administration) are headed by Deputy Directors General (DDG's). The Department of Safeguards and Inspection is headed by the Inspector General (IG) who has a rank and status equivalent to that of a DDG.

The Agency's total staff on June 30, 1975, was just over 1,240; staff members in the Professional and higher categories numbered 378. For that portion of the staff subject to geographical distribution, 56 Member States were represented; Americans held about 19% of these posts.

The U.S. Mission to the IAEA, located in Vienna, has a resident staff of six Professionals including the Resident Representative who is normally in charge. The U.S. Representative to the IAEA (Ambassador Gerald F. Tape) attends Board meetings, the General Conference and other special meetings that require his presence in Vienna, and at such times he is head of Mission. The staff Professional members are equally divided between career foreign service officers and experts in nuclear energy and non-proliferation matters.

The presence of an effective U.S. Mission in Vienna has long been recognized as a great source of strength by the Director General and others. It provides effective liaison with the many parties—the Agency, other Member States' Missions, the various elements of the U.S. Government—as well as a technical competence of its own. This U.S. leadership has resulted from a concerted effort by the Mission, the Department of State, the supporting Executive Branch Agencies, and the Congress.

SAFEGUARDS

The Agency's function which is probably of greatest importance to the United States is its Safeguards function. "Safeguards" is a system of inspection and control whose objective is the timely *detection* of diversion (at the national level) of significant quantities of nuclear material from peaceful nuclear activities to other purposes, such as the manufacture of nuclear weapons or other nuclear explosive devices, and the *deterrence* of such diversion by the risk of early detection. Since the founding of the Agency, the United States has taken a lead in creating an effective IAEA Safeguards system and, when possible, we have transferred to the IAEA responsibility for Safeguards on the materials which the U.S. provides bilaterally to other countries.

The main elements of a Safeguards system are: (1) an Agreement between the Agency and the government concerned, whether or not it is a Member of the Agency; (2) an examination of design information of those nuclear facilities to be included; (3) records required to be maintained by the facility and subject to examination by the Agency; (4) reports to the Agency concerning nuclear material produced, processed or used by the facility or transferred; and (5) on the spot inspections by Agency personnel to verify compliance with the Agreement.

To avoid confusion, let me emphasize that the term safeguards in the United States has many meanings. It has been expanded in recent years by some to include the physical protection of special nuclear material to prevent diversion or theft especially by terrorists or sub-national groups, and, in some instances, the definition has been extended to the prevention of sabotage of materials or equipment that might result in harm to the public. Although IAEA is concerned with all of these aspects and has issued guidance (most recently INFC IRC/255—The Physical Protection of Nuclear Material), its authority is confined to that included under the Safeguards Agreements which address independent verification by the Agency of a country's undertaking that material and equipment will not be diverted to military use. The Agency's ability to do this comes from its access to information and its broad rights of inspection in the territory of the cooperating country.

In recent years, particularly with the coming into force of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), the Agency's Safeguards functions have assumed increasing importance. Under the NPT, non-nuclear weapons states (NNWS) party to the Treaty (93 nations as of June 30, 1975) are required to accept Safeguards on all of their peaceful nuclear activities, under Agreements with the Agency, to insure that nuclear materials are not diverted from peaceful uses to nuclear weapons or other nuclear explosive devices. The Agency also plays a major role in the implementation of Articles IV and V of the NPT that call for international exchange of information and materials and other means of cooperation in peaceful applications of nuclear energy.

THE NPT REVIEW CONFERENCE

The Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons was held in Geneva last May. The Final Declaration included a number of statements having a direct bearing on the work of the IAEA and are pertinent to the substance of H. Con. Res. 371. It should be noted first that Article III of the NPT recognizes the IAEA as the body for establishing and implementing NPT Safeguards. The Conference urged that:

"In all achievable ways, common export requirements relating to safeguards be strengthened, in particular by extending the application of safeguards to all peaceful nuclear activities in importing States not Party to the Treaty;

"Such common requirements be accorded the widest possible measure of acceptance among all suppliers and recipients;

"All Parties to the Treaty should actively pursue their efforts to these ends."

Further, the Conference noted that:

"The considered view of many Parties to the Treaty that the safeguards required under Article III.2 should extend to all peaceful nuclear activities in importing States; . . ."

With regard to multinational nuclear fuel cycle centers, the Conference recognized that

"Regional or multinational nuclear fuel cycle centres may be an advantageous way to satisfy, safely and economically, the needs of many States in the course of initiating or expanding nuclear power programmes, while at the same time facilitating physical protection and the application of IAEA safeguards, and contributing to the goals of the Treaty."

An IAEA regional nuclear fuel cycle center study is under way. A project of this magnitude cannot be done by IAEA staff alone. It will require significant contributions in funds and by experts from a number of nations in the coming year. Secretary Kissinger in his UNGA speech of September 22, 1975, emphasized the need to address the establishment of multinational regional nuclear fuel cycle centers and urged the IAEA to move forward expeditiously. U.S. participation is both welcome and necessary.

There were other matters included in the NPT Review Conference Final Declaration having a bearing on IAEA activities and non-proliferation. They do not relate directly to the specific recommendations of H. Con. Res. 371 but they are of great importance to non-proliferation. We must continually remind ourselves that NNWS parties are forgoing the development and/or acquisition of nuclear weapons or other nuclear explosive devices but that they are not giving up their rights to the benefits arising from peaceful nuclear undertakings. To realize such benefits they need assistance from the more technologically advanced nuclear nations and especially from the NWS's. We must continue to recognize this in our bilateral relationships and in our work through the IAEA. U.S. voluntary contributions to the IAEA do much to meet this need.

Last year the Congress increased the U.S. voluntary contribution thereby permitting increased assistance to developing nations as well as additional technical assistance in Safeguards. President Ford in his communication to Congress on September 3, 1975, reported on the utilization of the additional $500,000 appropriated for fiscal year 1975. This balanced effort by the United States will be most effective.

HOUSE CONCURRENT RESOLUTION 371

Let me now speak to operative paragraph (3) of the Resolution; namely,

"The Congress of the United States, in order to reinforce international actions to prevent the proliferation of nuclear weapons and other nuclear explosive devices, urges a halt on further transfers of nuclear fuel, technology, and equipment to any country which has not accepted International Atomic Energy Agency Safeguards on all its nuclear programs or which by January 1976, has not become a party to the Treaty on the Non-Proliferation of Nuclear Weapons if all other major nuclear suppliers agree to a similar halt on such transfers."

A NNWS party of the NPT has through implementation of its required Safeguards Agreement placed its entire nuclear program under IAEA Safeguards. The submission by a NNWS not party to the NPT of all of its nuclear activities to IAEA Safeguards would achieve many of the objectives set forth by the NPT, especially those having to do with the control of special nuclear material and the timely detection of diversion to non-authorized purposes.

A world in which all NNWS's have their entire nuclear programs under IAEA Safeguards either by virtue of their being NPT parties or by unilateral submission to Agency Safeguards is a most worthy objective. There are many advantages, most of them arising from the application of a common system; for example, Safeguards are removed from the marketplace—suppliers and customers understand and respect the common standards; all material within a country is under the one system of control, accountability and inspection; greater uniformity is possible in effecting Agreements and in implementing Agreements; etc.

This is a most desirable objective or goal. Suppliers could make it clear that exports of nuclear fuel, equipment and technology could be expedited for recipients having effective full fuel cycle IAEA Safeguards. I must note for later reference, however, that operative paragraph (4) on regional fuel cycle centers seeks more restrictive conditions than would be called for by paragraph (3).

I note the caveat, ". . . if all other major nuclear suppliers agree to a similar halt on such transfers." Needless to say, the successful application of export restrictions such as those proposed are highly dependent on full cooperation among all potential suppliers. Even then, relationships between different pairs of supplier and customer countries will be different and it would be necessary to have an understanding as to what exceptions, if any, might be made. These relationships between countries are highly dependent upon common historical, political and economic factors and usually extend beyond matters solely of nuclear power considerations.

I have stressed that full fuel cycle Safeguards either as an NPT party or under a unilateral submission to IAEA is a desirable objective or goal. The overall mutual objective is still one of non-proliferation; however, we should never be so inflexible that in achieving the goal for the great majority of nations we drive a small number of important states to development of their own unsafeguarded nuclear capability. Let us not lose sight of the fact that no nation has an exclusive monopoly on the technology or materials.

Operative paragraph (4) urges that reprocessing, storage or fuel element fabrication involving plutonium be carried out in regional facilities with appropriate physical protection and safeguards. Specfically,

"The Congress of the United States urges an agreement providing that, with respect to any plutonium for peaceful uses resulting from any transfer between countries of nuclear fuel, technology, or equipment, all processing of such plutonium (from its extraction from spent reactor fuel elements through its processing, storage, and its final fabrication into new fuel elements and their installation into nuclear reactors) will be performed in regional facilities which are heavily protected and guarded under the strictest possible multinational safeguards."

This proposal has merit and appeal. It will, however, require a major initiative and a significant investment of technology and money by the parties. The nuclear fuel cycle center where large quantities of Pu would be processed and stored is, from the safeguards and physical protection point of view, the most sensitive part of the cycle. Further, there can be economics of scale and, by pooling, the requirements of smaller nations could be better satisfied than by a multitude of separate efforts. This is most important in the earlier phases of national nuclear power programs.

There are some difficulties with the proposal; however, I do not consider them insurmountable. As noted earlier, we must observe our obligations under the NPT and any conditions that would appear to extend beyond the Treaty would have to be by mutual agreement. Thus, as is stated in the operative paragraph (4), ". . . The Congress . . . urges an agreement . . ." This I interpret to mean a mutual agreement between supplier and customer. To be successful this calls for cooperation and consequently some initiative by suppliers, in technology transfer, construction, operation and management. It may also require capital investment and guarantees.

It would be much easier for the United States to be convincing if we had a civilian reprocessing facility operating successfully today. The existence of an actual operating plant would convince many nations of the benefits to be achieved through pooling of their limited resources with those of the more experienced nations. This will come; the timing is a bit unfortunate.

In the meantime, participation in studies such as that under way by IAEA (noted above) will help to identify the opportunities and the problems and will encourage international cooperation. Again, a successful conclusion is highly dependent upon the extensive participation by suppliers and, in our case, by the United States.

Finally, there is time since the demand for plutonium recycle beyond a test and demonstration phase is, in my opinion, many years away for most countries that would benefit from regional centers. There is, however, an earlier need for spent fuel storage, and a regional facility for such a purpose could possibly become the nucleus of a larger complex with the addition at a later date of specialized fuel fabrication and reprocessing facilities. The current studies should help to identify the merits of such an approach.

It is not too early to begin to work cooperatively with certain nations who because of their rapidly growing civil nuclear programs see the need for early resolution of fuel cycle problems. It is in our interest to do so. Agreement to proceed along the lines indicated would be much more readily achieved by U.S. participation than by leaving it to others. The one way to be influential is to be involved, to be a party.

Mr. Chairman, that concludes my prepared remarks.

Mr. ZABLOCKI. Thank you very much, Ambassador Tape, for that excellent presentation. We appreciate it, and we will hear from Commissioner Kennedy.

STATEMENT OF RICHARD T. KENNEDY, COMMISSIONER, NUCLEAR REGULATORY COMMISSION

Richard T. Kennedy was Deputy Assistant to the President for National Security Council Planning when he was nominated to the Nuclear Regulatory Commission (NRC) in December 1974. He assumed his duties for a five-year term on the first NRC on January 19, 1975, the date NRC formally came into being. At the time of his designation as Deputy Assistant to the President, Mr. Kennedy was Director of the National Security Council Staff Planning Group. He had been a senior staff member of the Security Council Staff since October 1969. Born on December 24, 1919, in Rochester, New York, Mr. Kennedy was graduated with a Bachelor's degree in Economics from the University of Rochester in 1941. He holds a Master's degree with Distinction from the Harvard Graduate School of Business Administration. He also is a graduate of the National War College in Washington, D.C. Mr. Kennedy retired as a Colonel in 1971 after 30 years of service in the United States Army. During World War II, he served with the First Armored Division in Europe. His subsequent service included assignments with the Assistant Secretary of the Army, the Army Staff, the Assistant Secretary of Defense for International Security Affairs, and the Military Mission to Iran.

Mr. KENNEDY. Thank you, Mr. Chairman. I will take advantage, sir, of the offer you have made to let me summarize my statement if I may.

I appreciate very much the opportunity of coming before your committee this afternoon to explain the Nuclear Regulatory Commission's role in the export license process for nuclear materials and production facilities, and also to explain the relationships which we in the Commission have with the executive branch agencies who are also deeply involved in this process, and to give you an idea of the factors which we assess in evaluating export license applications. Then I will express some thoughts about the measure which you have before you in the joint resolution.

At the outset, I would like to emphasize that the vast bulk of the work of the NRC concerns regulation of domestic civil nuclear power. This is the area in which our expertise lies and, therefore, also is the area in which we have a particular technical contribution to make in the export control process.

But clearly, nuclear export control is much more than a technical assessment of foreign safeguards standards. It embraces a number of crucial foreign relations and arms control issues that to a large extent are the responsibility of the President and the foreign affairs and defense agencies of the executive branch.

NRC EXPORT LICENSES CATEGORIZED

Before going on to explain how we perform our functions, I want to explain the categories of exports that the NRC licenses: First, nuclear power reactors; second, the major component parts for those reactors, and third, reactor fuel and other special nuclear materials. They are all licensed by the NRC.

Each of these can be exported only under the terms of an agreement for cooperation between the United States and the recipient country and only after a specific determination has been made by the NRC that the issuance of the license would not be inimical to the common defense and security. This is required by the Atomic Energy Act.

When the Nuclear Regulatory Commission came into being, it entered an era which was slightly different from that which preceded it.

In earlier days, the Atomic Energy Commission, which had both licensing and promotional responsibilities and development responsibilities, was not only an active participant in the negotiation of the agreements for cooperation, but also was responsible for approving the licenses for nuclear exports which might emerge later on.

Our problem then, as we came into being as an independent regulatory agency, was to establish a relationship in our activities in the export control area with the executive branch agencies that were already deeply involved in this process. We needed to do so in a way that would recognize and preserve the Commission's statutory responsibilities for making independent licensing decisions, while at the same time making effective use of the relevant information and assessments which only the executive branch agencies could provide for us.

INDEPENDENT ROLES MAINTAINED BY WORKABLE PROCEDURES

I believe that the NRC and the executive branch agencies have devised workable procedures which permit the NRC to retain its independent role in the export process and at the same time avoid duplication of the work and responsibilities of the executive branch agencies.

Briefly, these procedures work as follows:

First, we receive an application to export nuclear facilities or materials. We send those copies of the request to the Department of State and ask for certain information and assessments which the executive branch might have which would bear on the particular export in question.

The focus for this activity within the executive branch is the Department of State. State, however, consults all relevant agencies, including ERDA, the Arms Control and Disarmament Agency, the Department of Defense, et cetera, as the particular case might require.

State then forwards to the NRC the executive branch's analysis and pertinent and required information, which we need, together with the executive branch's view on the license application, giving us as well its opinion—that is, the opinion of the executive branch as to whether the export would be inimical to the common defense and security.

In determining whether a license can and should be issued, our basic task at the Commission is to ascertain that the export will ultimately be used for its intended peaceful purposes and that appropriate safeguards will be applied against diversion to any military or explosive use.

INFORMATION CONSIDERED IN ASSESSING POTENTIAL LICENSES

The information we consider in making this determination is generally of two types. This is the kind of information which we specifically request of the executive branch:

First, technical data as regards safeguards. That is, materials accounting on the one hand and physical security on the other; and

Second, information of a more general policy nature bearing on the relation of the particular export to U.S. nonproliferation objectives.

That is a summary of how we go about the export licensing process.

The basic mechanism through which the United States pursues its international safeguards objectives—the fundamental concern in the licensing process from our perspective—is the International Atomic Energy Agency.

Under our agreements for cooperation in nuclear energy with countries to whom we export, the United States has transferred to the IAEA the responsibility for maintaining and verifying the materials accounting system which assures that U.S.-supplied civil nuclear facilities and materials are not diverted from their intended peaceful use.

Other supplier countries also use the IAEA system to safeguard their exports, as Dr. Tape has already noted. In this way, a unified international system of export control has been established.

IAEA SAFEGUARDS SYSTEM IN NEED OF CONSTANT REVIEW

In my view, the IAEA provides a sound framework for assuring the level of safeguards which we require. But international nuclear trade is constantly expanding both in magnitude and scope. Consequently, from our perspective, the IAEA safeguards system must be kept under continuing review and analysis for improvements.

I would emphasize that the IAEA's system, on which we and other suppliers heavily rely, must receive strong support, both financially and through personnel assignments, from member governments. The United States participates actively in this effort, as Dr. Tape has noted. The NRC actively participates with other interested U.S. Government agencies in the effort.

The potential threat posed by the possibility of theft of nuclear materials by terrorists or criminal groups has been given increasing attention and has resulted in widespread effort to strengthen physical security measures.

The IAEA has recommended international physical security standards, which are very similar to the physical security standards which the NRC applies in the United States.

But the task of providing physical security for nuclear materials is basically the responsibility of the country where the materials are located.

In evaluating the technical aspects of foreign safeguards arrangements, the Commission recognizes that it is not always necessary nor even desirable that the recipient country have physical security measures identical to those required in the United States.

Specific measures applied in the United States are not necessarily appropriate to the problems of safeguarding exported nuclear facilities and materials in other countries where different societal conditions and modes of operation may exist.

OBSERVATIONS ON RESOLUTION AIRED

I would like now to make just a few brief observations in closing, on the resolution you are considering. As a general observation, I would note that the nonproliferation measures proposed in this resolution depend heavily on international consensus for their effectiveness.

The resolution calls for a halt of nuclear exports to non-NPT signatories provided that all other major nuclear suppliers agree to a similar halt.

I believe that this is a realistic approach to this vital problem and sets a desirable goal for international nuclear export policy.

The United States, of course, is only one of many nuclear exporters. It cannot unilaterally dictate the terms and conditions of international nuclear trade. Our greatest long-run impact on nonproliferation, therefore, will result from maintaining our position of leadership, presence, and active international cooperation in nuclear export control efforts.

Giving effect to the measures in this resolution will depend heavily on reaching agreement not only with recipient countries, but also with other suppliers.

To obtain such a consensus among the suppliers may admittedly entail overcoming significant obstacles in negotiations, and on this I would defer to our colleagues in the Department of State.

I believe, however, that the stakes are so high that the United States should continue its efforts to promote the kind of active cooperation among supplier countries that is needed to bring more and more of the world's peaceful nuclear activities under effective international safeguards. The ultimate objective should be if possible, to have all peaceful nuclear activities safeguarded.

REGIONAL FACILITIES LAUDED AS DESIRABLE GOAL

The resolution you are considering also urges the establishment of regional facilities for the processing of plutonium. Here again, I believe the resolution expresses a desirable goal. There are a number of complex economic, foreign policy, and safeguards factors that need to be analyzed in connection with this proposal. Therefore, I believe an important next step in pursuing this objective will be its analysis in the IAEA in detail and its consideration by both supplier and recipient countries alike.

If such a concept can achieve the necessary international acceptance, it will mark a major step forward toward assuring the adequate safeguarding of the international nuclear fuel cycle.

Thank you very much, Mr. Chairman.

[The prepared statement of Commissioner Kennedy follows:]

Prepared Testimony of Richard T. Kennedy

Mr. Chairman, thank you for affording me this opportunity to appear before your Subcommittee to explain the U.S. Government export licensing process for nuclear materials and production facilities. I would like to outline briefly for the Subcommittee the role of the Nuclear Regulatory Commission and its relationships with other Federal agencies in nuclear export matters, factors which the NRC assesses in evaluating export license applications, and the NRC's perspective on international safeguards, specifically as to the non-proliferation measures proposed in the resolution before you.

At the outset, I want to emphasize that the vast bulk of the work of the NRC concerns the regulation of domestic civil nuclear power. This is the area in which our expertise lies and is, therefore, the area in which we have a particular technical contribution to make in the export control process. However, clearly nuclear export control is much more than a technical assessment of foreign safeguards standards. It embraces a number of crucial foreign relations and arms control issues that for the most part are the responsibility of the President and the foreign affairs and defense agencies of the Executive Branch.

But, before I discuss how those issues arise, let me first briefly describe the types of exports about which we are speaking. There are basically three categories of exports subject to NRC licensing: nuclear power reactors, important component parts for reactors, and reactor fuel and other special nuclear materials. Each of these can be exported only under the terms of an agreement for cooperation between the United States and the recipient country, and only after a specific determination has been made that the issuance of the license would not be "inimical to the common defense and security" as specified in section 103, 104, 109, and 53 of the Atomic Energy Act of 1954.

I should note that the NRC's authority to issue export licenses for important component parts especially designed for nuclear facilities is discretionary, as was the Atomic Energy Commission's. Rather than exercise its authority in this area, the AEC concluded an agreement with the Department of Commerce in 1963 under which the Department would exercise jurisdiction over export licensing of reactor components with assistance from the AEC, as necessary. The Commerce Department continues to exercise this authority with technical assistance from the Energy Research and Development Administration, as needed.

Direct government-to-government transfers of nuclear facilities and materials are not subject to licensing by the NRC. ERDA has the authority under the Atomic Energy Act to transfer such items, subject in general to the same terms and conditions as applied by NRC to licensed material.

The agreements for cooperation which I mentioned, are agreements negotiated by the Executive Branch with foreign countries providing for the transfer of nuclear materials and technology subject to certain specific guarantees. These guarantees include provisions on the safeguards to be applied to transferred materials and facilities, peaceful use assurances, and provisions controlling retransfer.

These agreements for cooperation which are negotiated by the Department of State and the Energy Research and Development Administration are submitted to and approved by the President who must determine in writing that an agreement does not pose an unreasonable risk to the common defense and security of the United States. The President then submits the proposed agreement to the Congress for its examination. An agreement becomes effective 60 days after submission unless the Congress disapproves the agreement by concurrent resolution.

Prior to passage of the Energy Reorganization Act, the Atomic Energy Commission was not only an active participant in the negotiation of agreements for cooperation, but also was responsible for approving and issuing licenses for nuclear exports. Thus, when the Nuclear Regulatory Commission—an independent regulatory agency—was formed by the Energy Reorganization Act in January of this year, it faced the task of relating its activities in the export control area to the activities of the Executive Branch agencies already heavily involved in the process. And it needed to do so in a way that would recognize and preserve the Commission's statutory responsibilities for making independent licensing decisions, while at the same time making effective use of the relevant information and assessments which only the Executive Branch agencies could provide.

I believe that the NRC and the Executive Branch agencies have devised workable procedures which both permit NRC to retain its independent role in the export process and avoid duplication of the work and responsibilities of the Executive Branch agencies.

Briefly, these procedures work as follows:

When NRC receives an application to export nuclear facilities or materials, we send copies to the Department of State and ask for information and assessments which the Executive Branch might have which would bear on the particular export. The focus for the activity within the Executive Branch is the Department of State. State, however, consults all relevant agencies, including ERDA, the Arms Control and Disarmament Agency, and the Department of Defense, as the particular case may require.

The State Department then forwards to the NRC the Executive Branch analysis and pertinent and required information together with the Executive Branch view on the license application including the opinion as to whether the export would be inimical to the common defense and security.

While the NRC does not participate formally in the Executive Branch evaluation process, we maintain staff level liaison with the Executive agencies so that the information we are provided will be responsive to the Commission's needs.

In determining whether a license can be issued, the Commission's basic task is to ascertain that the export will be used for its intended peaceful purposes and that appropriate safeguards are applied against diversion to any military or explosive use. The information we consider in making this determination is generally of two types:

First, technical data relating to safeguards—that is, materials accounting and physical security; and

Second, information of a more general policy nature bearing on the relation of the particular export to United States non-proliferation objectives.

The first category of data—technical safeguards information—includes material relating to the terms of the agreement for cooperation between the United States and the recipient country, the international materials accounting safeguards implemented for the given export, and the recipient's practices with respect to the physical security of significant quantities of plutonium or highly enriched uranium suitable for making weapons.

The second category of information includes the Executive Branch's assessment of the recipient country's position with regard to non-proliferation, the United States Government's understandings regarding the recipient country's intention with respect to nuclear explosives, and any other information within the purview of the Executive Branch bearing on the issuance of the export license. All of this information—together with assessments and information developed independently by the NRC—is considered by the NRC when it makes the final determination as to the issuance of the export license.

The basic mechanism through which the United States pursues its international safeguards objectives is the International Atomic Energy Agency. Under our agreements for cooperation in nuclear energy with countries to whom we export, the United States has transferred to the IAEA the responsibility for maintaining and verifying the materials accounting system which assures that U.S.-supplied civil nuclear facilities and materials are not diverted from their intended peaceful use. Other supplier countries also use the IAEA system to safeguard their exports. In this way a unified international system of export control has been created.

In my view, the IAEA safeguards standards system, together with continuing international support for the IAEA, provides a sound framework for assurance that U.S. peaceful nuclear exports will not be diverted to a nuclear weapons program. However, international nuclear trade is constantly expanding both in magnitude and scope. Consequently, the IAEA safeguards system—just as in the case of our own domestic system—must be kept under continuing review and analysis and improved to assure that its effectiveness will keep pace with the challenge of changing requirements. I would emphasize that the IAEA's system, on which we and other suppliers heavily rely, also must receive strong support, both financially and through personnel assignments, from member governments. The NRC actively participates with other interested U.S. Government agencies in this effort.

The United States is vigorously pursing wider adoption of the Non-Proliferation Treaty, a major bulwark in the international effort to prevent proliferation. The Treaty provides, in part, that no non-nuclear weapon state will accept, manufacture, or receive assistance in the manufacture of a nuclear explosive device, and that nuclear weapon states will give assistance and non-nuclear weapon states will receive assistance only under IAEA safeguards.

In addition to materials accounting systems, the United States also is concerned with the physical security of nuclear materials which could be used to make an explosive device—specifically, significant quantities of high enriched uranium or plutonium. The potential threat posed by the possibility of theft of nuclear materials by terrorist or criminal groups has been given increasing attention and has resulted in widespread efforts to strengthen physical security measures.

The IAEA has recommended international physical security standards, which are very similar to the physical security standards the NRC applies in the United States. But the task of providing physical security for nuclear materials is basically the responsibility of the country where the materials are located. The United States follows a policy of providing material which potentially could be used to build a weapon, only if we are assured that the recipients' physical security standards and practices are adequate.

In evaluating the technical aspects of foreign safeguards arrangements, the Commission recognizes that it is not always necessary nor even desirable that the recipient country have physical security measures identical to those required in the United States. This approach acknowledges that U.S. safeguards measures are developed and applied to our domestic nuclear industry to meet the specific conditions existing in this country. These conditions, and the measures adopted in light of them, are not necessarily appropriate to the problem of safeguarding exported nuclear facilities and materials in other countries where different societal conditions and modes of operation may exist. Thus U.S. practices, while useful as a reference base for evaluation purposes, cannot be made an inflexible standard against which the adequacy of foreign safeguards must be judged.

I would like to now make a few brief observations on the resolution you are considering. I will not comment on those points of the resolution dealing with the strategic arms limitation talks and a nuclear test ban, since these are clearly outside the area of expertise of NRC.

As a general observation, I would note that the non-proliferation measures proposed in this resolution depend heavily on international consensus for their effectiveness. The resolution calls for a halt on nuclear exports to non-NPT signatories provided that all other major nuclear suppliers agree to a similar halt. I believe that this is a realistic approach to this vital problem and sets a desirable goal for international nuclear export policy. The United States is, of course, only one of many nuclear suppliers. It cannot unilaterally dictate the terms and conditions of international nuclear trade. Our greatest long-run impact on nonproliferation, therefore, will result from maintaining our position of leadership, presence, and active international cooperation in nuclear export control efforts. Giving effect to the measures in this resolution will depend heavily on reaching agreement not only with recipient countries, but also with supplier countries. To obtain such a consensus among the suppliers admittedly may entail overcoming significant obstacles in negotiations. I believe, however, that the stakes are so high that the United States should continue its efforts to promote the kind of active cooperation among supplier countries needed to bring more and more of the world's peaceful nuclear activities under effective international safeguards, with the ultimate objective—if possible—of having all peaceful nuclear activities safeguarded.

The resolution you are considering also urges the establishment of regional facilities for the processing of plutonium. Here again, I believe the resolution expresses a desirable goal. There are a number of complex economic, foreign policy and safeguards factors that need to be analyzed in connection with this proposal. Therefore, I believe an important next step in pursuing this objective will be its analysis in the IAEA and consideration by both supplier and recipient countries. If such a concept can achieve the necessary international acceptance, it will mark a major step forward toward assuring the adequate safeguarding of the international nuclear fuel cycle.

Thank you, Mr. Chairman, this concludes my prepared statement.

Mr. ZABLOCKI. Thank you, Commissioner Kennedy. The committee will stand in recess for 5 minutes. We have a rollcall vote.

[A short recess was taken.]

Mr. ZABLOCKI. The subcommittee will resume its hearing.

We will next hear from Mr. Nelson Sievering.

STATEMENT OF NELSON F. SIEVERING, JR., ASSISTANT ADMINISTRATOR FOR INTERNATIONAL AFFAIRS, U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

Since January 1973, Mr. Sievering has been serving as Deputy Director of the Bureau of Oceans, International Environmental and Scientific Affairs, in the Department of State. Born on December 8, 1924, at Newark, New Jersey, Mr. Sievering was graduated from Yale University in 1945 with a B.S. degree in chemical engineering. He received his M.S. degree in chemical engineering from Columbia University in 1948. He also attended New York University Graduate School of Business Administration. Mr. Sievering joined the Atomic Energy Commission in 1948 and served in a number of positions in the field and in Wash-

ington D.C. During his 17 years in the Atomic Energy Commission his positions included Chief of the Feed Materials Branch, Division of Production, AEC European Scientific Representative in Brussels, and Associate Director for Advanced Systems, Division of Reactor Development. Mr. Sievering joined the Department of State in 1965 as Deputy Director, Office of Atomic Energy Affairs of the Bureau of Scientific and Technological Affairs. He subsequently served as Director of the Office of Scientific Affairs and Deputy Director of the Bureau. He received the Department's Superior Honor Award in 1967.

Mr. SIEVERING. Thank you, Mr. Chairman.

I will attempt to summarize my remarks, and I apologize if in so doing I repeat some of the things that Ambassador Tape and Mr. Kennedy have said.

I welcome the opportunity, sir, to appear on behalf of the Energy Research and Development Administration to testify with respect to the nonproliferation measures proposed in the resolution now before the committee. House Concurrent Resolution 371.

The particular measures to which I will address my comments are those set out in paragraphs 3 and 4 of the proposed resolution.

ERDA has responsibilities in the research and development of nuclear weapons. The issues raised in paragraphs 1 and 2 are appropriately addressed by the Department of Defense, which I respectfully suggest the committee consider.

U.S. cooperative activities in peaceful nuclear applications are conducted pursuant to the Atomic Energy Act of 1954, as amended, which provides for—and I will quote here:

> A program of international cooperation to . . . make available to cooperating nations the benefits of peaceful applications of atomic energy as widely as expanding technology and considerations of the common defense and security will permit.

Under this program, the United States has cooperated with other nations and international organizations in a wide range of activities.

ACTIVITIES CONDUCTED PURSUANT TO COOPERATION AGREEMENTS

Many of these activities are conducted pursuant to agreements for cooperation between the United States and the other nations. Nuclear reactors and special nuclear materials may not be licensed for export except under such an agreement.

These agreements are negotiated by the Energy Research and Development Administration and the Department of State, are approved by the President, and are subject to review by the Congress.

The agreements typically contain guarantees that material and equipment and any nuclear material produced as a result of their use will not be used for atomic weapons or for research or development of atomic weapons or for any other military purpose; that stipulated safeguards will be maintained; and that these items will not be transferred outside the recipient countries' jurisdiction without our approval.

Now, during the early period of our program of international cooperation, the United States supplied safeguards in foreign nations with its own safeguard staff. From the beginning, however, the concept of international safeguards has been a cornerstone of U.S. policy.

The United States has consistently held the position that to gain wide acceptance and credibility as an effective deterrent to nuclear weapons proliferation, a safeguards system should be international in character and internationally administered with respect to materials supplied not only by the United States, but by other nations as well.

It is for these reasons that the United States assisted the International Atomic Energy Agency in setting up its international safeguards system in the early 1960's and has continued to help the Agency develop this system.

The safeguards provisions of the U.S. bilateral agreements for cooperation are suspended while the IAEA is applying safeguards, but guarantees and other provisions of our bilateral agreements, however, remain in effect, and the United States retains the right to implement safeguards directly should the IAEA not be in a position to do so for any reason.

SUBJECT OF REPROCESSING IN LIMELIGHT

Because of the increased growth of nuclear power and the resultant concern with produced plutonium, the subject of reprocessing has drawn special attention in recent years.

As protection against the possible diversion of produced plutonium to weapons use, our agreements for cooperation with individual nations give the United States rights to approve the selection of facilities in which U.S.-supplied fuel material would be reprocessed.

In new agreements for cooperation, we propose to strengthen this control feature by including a provision specifically providing the United States with rights not only to approve the undertaking and selection of facilities for reprocessing, but also for the storage, processing, and fabrication of the produced plutonium.

In light of the increased risk of proliferation that could be expected to result from the spread of nuclear reprocessing facilities under the control of many individual nations, the United States strongly supports the concept of multinational regional nuclear fuel cycle centers.

Moreover, preliminary estimates indicate that there may be significant economic advantages associated with large-scale regional reprocessing plants.

REGIONAL REPROCESSING CONCEPT POSES QUESTIONS

There are, of course, some difficult and complex questions to be answered before this concept can be realized. Who would make the decision on the location of a regional facility? Who would construct and operate it? Private industry, an intergovernmental body, an international organization? Who would put up the funds for the large capital investment required?

The IAEA, as Ambassador Tape has mentioned, has underway a major study of the technical, the economic, the organizational, and the financial aspects of the regional center concept.

We believe that this study, for which the United States is providing strong support, will provide much valuable information regarding the concept.

Like reprocessing, the subject of physical security has received intensified attention in recent years, on both the national and international level as the general level of terrorism has grown.

The United States is cooperating extensively with other nations bilaterally to strengthen national physical security programs. We have also adopted a policy of requiring acceptable physical security measures as one condition for another country to receive significant quantities of strategic nuclear materials from the United States.

Furthermore, we intend to include a provision in future agreements for cooperation requiring acceptable physical security arrangements on all materials and equipment supplied.

SAFEGUARDS REFLECT RATIONAL APPROACH

The United States, as has been mentioned by both Ambassador Tape and Commissioner Kennedy, is working with the IAEA to establish and encourage the widespread adoption by nations of common international standards in this important area, and the Agency has recently issued a detailed guide on physical security.

I believe the safeguards and controls the United States has employed and evolved over the past 20 years reflect a rational and responsible approach to international cooperation in the nuclear field during this period.

This has involved a new and evolving and complex technology, shared on a broad scale under unprecedented national and international controls.

With changing circumstances, we are taking and we must take steps to further tighten controls over various aspects of our cooperation.

At the same time, it must be recognized that the changing circumstances have imposed certain limits on the effectiveness of U.S. unilateral controls.

The United States no longer has the leverage to affect developments that it once had as the only major supplier as recently as 10 or even 5 years ago. Now other nations are or have the potential of supplying power reactors and other elements of the fuel cycle on the world market.

EFFECTIVENESS OF PROLIFERATION METHODS DEPENDS ON ATTITUDES

The scope and the effectiveness of nonproliferation measures depends on the attitudes and policies of many supplier nations.

Fortunately, a generally shared perception of the risks of proliferation and the need for effective nonproliferation policies is developing among the major suppliers, and some significant steps have already been taken to coordinate common policies.

Soon after the entry into force of the NPT, which was, of course, the first major multinational step toward international supplier responsibility in the nuclear field, the United States and several other principal supplier states undertook discussions looking toward agreement on specific items of materials and equipment on which, in the case of exports to non-nuclear-weapon states, they would require IAEA safeguards. Agreement on a list of items was reached in 1974.

Since then, the United States has continued to explore the development of common policies with other supplier nations.

In the ongoing discussions in which the United States and other principal supplies are engaged, each nation must consider and assess a number of factors in light of its own interests and perspectives.

These factors include policies for sharing technology with others, competition for markets, and the risk that too many or too rigid restrictions may drive countries to develop indigenous and unsafeguarded nuclear capabilities.

Different countries may give different weights to these factors, making it difficult to achieve complete unanimity on proposed nonproliferation policies.

REQUIREMENT OF SAFEGUARDS BY ALL SUPPLIERS

I would like to emphasize, however, that today all other principal suppliers, like the United States intend to require IAEA safeguards on nuclear transfers to non-nuclear-weapon states. We know of no contemplated transfer to a non-nuclear-weapon states on which the supplier will not require these safeguards.

This could, in effect, then result in safeguarding the entire nuclear programs of recipient countries if all future nuclear facilities and materials are simply not available for export without safeguards.

I am also pleased to note that progress has been made in dealing with the problems related to technology transfer and specifically to the need for assuring safeguards on facilities constructed through the use of supplied technology.

Two recent agreements of other countries have included provisions that any facilities constructed in the recipient nations through the use of supplied technology will be subject to IAEA safeguards.

NEED FOR COMMON SUPPLY POLICIES

The need for common supply policies is clearly recognized in paragraphs 3 and 4 of the proposed House Concurrent Resolution 371. We concur as to the desirability of the goals reflected in those paragraphs: comprehensive IAEA safeguards as a condition of supply and a requirement that reprocessing be performed in properly protected regional facilities under international safeguards.

This is a goal we are striving to attain through the continuing, step-by-step discussions with other supplier nations. As I have indicated, the task of working out common policies is a complex one involving, as it does, many nations, which, while sharing a concern about the risks of proliferation, may approach the problem with different attitudes and policies.

Nevertheless, the solutions to the problem must be found on the basis of agreement among the supplier nations, as is recognized in the proposed resolution, and requires, in our judgment, patient and continuing negotiations.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Sievering follows:]

PREPARED STATEMENT OF NELSON F. SIEVERING, JR.

Mr. Chairman and Members of the Committee, I welcome this opportunity to appear on behalf of the Energy Research and Development Administration

(ERDA) to testify with respect to the non-proliferation measures proposed in the resolution now before this Committee—Concurrent Resolution 371. The particular measures to which I will address my comments are those set out in paragraphs three and four of the proposed resolution. As background for my comments. I would like first to review the development and evolution of international nuclear supply arrangements from the time, not so long ago, when the U.S. was the only major supplier, to today's contrasting situation, in which many suppliers are involved in an expanding international market; and then to discuss some of the steps being taken to develop common supply policies designed to deter proliferation.

U.S. cooperative activities in peaceful nuclear applications are conducted pursuant to the Atomic Energy Act of 1954, as amended, which provides for "a program of international cooperation to . . . make available to cooperating nations the benefits of peaceful applications of atomic energy as widely as expanding technology and considerations of the common defense and security will permit." Under this program, the U.S. has cooperated with other nations and international organizations in a wide range of activities, including the sale abroad of U.S. power and research reactors and nuclear fuels; technical exchange arrangements; and the distribution of unclassified literature on nuclear technology.

Many of these activities are conducted pursuant to Agreements for Cooperation between the U.S. and other nations and international organizations. Nuclear reactors and special nuclear materials may not be licensed for export except under such an agreement. These agreements are negotiated by the Energy Research and Development Administration and the Department of State, are approved by the President, and are subject to review by the Congress. The agreements typically contain guarantees that material and equipment and any nuclear material produced as a result of their use will not be used for atomic weapons or for research on or development of atomic weapons or for any other military purpose; that stipulated safeguards will be maintained; and that these items will not be transferred outside the recipient countries without U.S. approval. In connection with the guarantee against use for any military purpose, the U.S. has made it clear that this precludes the use of materials or equipment for any nuclear explosive device, regardless of the intended purpose. To avoid any possible misunderstanding, however, the U.S. is including in new agreements a specific provision to this effect.

Safeguards applied to nuclear materials and equipment exported under Agreements for Cooperation include review of the design of facilities, examination of records, receipt of reports, and inspections. The provision for inspections is particularly significant in view of the unprecedented nature of arrangements under which nations have agreed to admit outside inspectors having rights of access and investigation to verify compliance with international understandings. During the early period of our program of international cooperation, the U.S. applied safeguards in foreign nations with its own safeguards staff. From the beginning, however, the concept of international safeguards has been a cornerstone of U.S. policy. The U.S. has consistently held the position that to gain wide acceptance and credibility as an effective deterrent to nuclear weapons proliferation, a safeguards system should be international in character and internationally administered with respect to materials supplied not only by the U.S., but by other nations as well. Such a system serves to provide the desired assurances regarding the use of nuclear materials not only to the supplier but to the world community as a whole.

For these reasons, the U.S. assisted the International Atomic Energy Agency (IAEA) in setting up its international safeguards system in the early 1960's, and has continued to help the Agency develop this system. When the system was sufficiently advanced, the U.S. started (in 1963) to transfer to the Agency, through trilateral agreements with the Agency and the other nations concerned, the responsibility for implementing the safeguards provisions of our Agreements for Cooperation. In non-nuclear weapons states (NNWS) party to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), the IAEA applies safeguards on U.S.-supplied materials, and on nuclear materials produced through the use of U.S.-supplied materials or equipment, under safeguards agreements negotiated pursuant to the NPT. Safeguards provisions of the bilateral Agreements for Cooperation are suspended while the IAEA is applying safeguards under the trilaterals or NPT agreements. Guarantees and other provisions of our bilateral agreements remain in effect, and the U.S. retains the right to implement safeguards directly should the IAEA not be in a position to do so for any reason.

In connection with the Agency's application of safeguards under agreements made pursuant to the NPT, it is worthy of note that the NPT is the first broad multinational treaty under which nations have voluntarily agreed to accept verification of their obligations through inspections conducted on their national territories by an international body.

By far the major portion of nuclear materials exported from the U.S. under Agreements for Cooperation is supplied in the form of low-enriched uranium to fuel nuclear power reactors. This low-enriched uranium—uranium containing three or four percent of the fissionable isotope U–235—is not attractive for diversion to non-peaceful uses prior to its use as fuel in a reactor. However, irradiation of the fuel in reactors results in the production of plutonium, a potential weapons material. This produced plutonium can be extracted from the irradiated fuel in an operation known as reprocessing. As protection against the possible diversion of produced plutonium to weapons use, our Agreements for Cooperation with individual nations—except, for historical reasons, an agreement with Canada and one with the United Kingdom—give the U.S. rights to approve the selection of facilities in which U.S.-supplied fuel material would be reprocessed. In new Agreements for Cooperation, the U.S. proposes to strengthen this control feature by including a provision specifically providing the U.S. with rights not only to approve the undertaking and selection of facilities for reprocessing, but also for the storage, processing and fabrication of the produced plutonium.

Because of the increased growth of nuclear power and resultant concern with produced plutonium, the subject of reprocessing has drawn special attention in recent years. In light of the increased risk of proliferation that could be expected to result from the spread of nuclear reprocessing facilities under the control of many individual nations, the U.S. strongly supports the concept of multinational regional nuclear fuel cycle centers. It is envisaged, under this concept, that the plutonium in irradiated fuel from several countries of a region could be reprocessed in such centers under conditions assuring the effective application of IAEA safeguards and strong physical security measures. Moreover, preliminary estimates indicate that there may be significant economic advantages associated with large scale regional reprocessing plants.

There are, of course, difficult and complex questions to be answered before this concept can be realized. For example, who would make the decision on the location of a regional facility? Who would construct and operate it—private industry, an intergovernmental body, an international organization? Who would put up the funds for the large capital investment required? The IAEA has under way a major study of the technical, economic, organizational, and financial aspects of the regional center concept. We believe that this study, for which the U.S. is providing strong support, will provide much valuable information regarding the concept.

Like reprocessing, the subject of physical security has received intensified attention in recent years, on both the national and international level. The physical protection of nuclear facilities and materials against sabotage or theft by sub-national groups has become of increased importance as the general level of terrorism has grown. It should be noted here that the IAEA safeguards system, which is designed to detect, and to deter by the threat of detection, diversion of materials, regardless of by whom, the system does not include physical security measures. Physical security systems are the responsibility of national governments to install and implement.

The U.S. is cooperating extensively with other nations bilaterally to strengthen national physical security programs. We have also adopted a policy of requiring acceptable physical security measures as one condition for another country to receive significant quantities of strategic nuclear materials from the U.S. Furthermore, we intended to include a provision in future Agreements for Cooperation requiring acceptable physical security arrangements on all materials and equipment supplied.

The U.S. is also working with the IAEA to establish and encourage the widespread adoption by nations of common international standards in this important area, and the Agency has recently issued a detailed guide on physical security. That other nations share our concern is indicated by the emphasis placed on physical security in the Final Declaration adopted by the NPT Review Conference in May 1975, which called upon all states to enter into such international arrangements as necessary to insure the physical protection of nuclear materials and to give the earliest possible effective application to the recommendations in the guide published by the IAEA. Subsequently, the General Conference of the IAEA last month adopted a resolution on the subject, urging all member states to review and if necessary strengthen their national physical security systems, and calling on members and the IAEA Director General to consider ways of facilitating international cooperation in this area. The U.S. has proposed an international convention setting standards for the physical protection of nuclear materials.

The U.S. also provides strong support to the IAEA in strengthening its safeguards system as necessary in light of the increasing amount of nuclear materials available throughout the world and the growth in the number and complexity of nuclear facilities. U.S. support has taken such forms as expert advice in establishing and upgrading safeguards procedures and in developing analytical techniques to enhance the Agency's ability to carry out its safeguards functions, research and development in instrumentation for passive surveillance of fuel, and the training of IAEA inspectors. I would like to commend the action taken by the Congress, in the Foreign Assistance Act of 1974, to expand U.S. assistance to IAEA safeguards. The Congress provided that a reasonable amount of the funds made available to the Agency under that Act should be used to strengthen IAEA safeguards. Thanks to that provision, we were able in 1975 to undertake a new $200,000 safeguards support program. Details of this program are provided in the "President's Report to the Congress on U.S. Actions to strengthen IAEA safeguards," dated September 3, 1975.

In addition to controls on the export of nuclear reactors and materials, the Atomic Energy Act of 1954 provides for controls on the provision of technological assistance to other countries. Section 57.b of the Act states that it shall be unlawful for any person under U.S. jurisdiction to engage directly or indirectly in the production of special nuclear materials outside the U.S. except under an Agreement for Cooperation or upon authorization by the Administrator of ERDA after a determination that the proposed activity will not be inimical to the interest of the U.S. In the late 1950's, the AEC issued a general authorization for U.S. persons and companies to engage in unclassified activities in the atomic energy programs of countries other than those of the Soviet Bloc. However, as the result of foreign interest in obtaining assistance by U.S. industry in the critical areas of uranium enrichment, fuel reprocessing, and heavy water production, the regulations were amended in 1972 to require specific authorization for participation in activities in these areas outside the United States.

I believe that this brief review of the safeguards and controls the U.S. has employed and evolved over the past 20 years reflects a rational and responsible approach to international cooperation in the nuclear field during this period. This has involved a new, evolving, and complex technology, shared on a broad scale under unprecedented national and international controls. With changing circumstances, we are taking steps to further tighten controls over various aspects of our cooperation.

At the same time, it must be recognized that the changing circumstances have imposed certain limits on the effectiveness of U.S. unilateral controls. The U.S. no longer has the leverage to affect developments that it once had as the only major supplier, as recently as ten or even five years ago. Now, other nations are, or have the potential of, supplying power reactors and other elements of the fuel cycle on the world market. This includes the provision of uranium enrichment services, which are becoming available in Europe (Eurodif and Urenco), the U.S.S.R., and undoubtedly in the future, South Africa. And the demand for nuclear power and related services has risen dramatically in recent years as a result of increased energy needs, coupled with a desire of many countries to develop alternative energy sources as a result of the 1973 oil embargo. Thus, the scope and effectiveness of non-proliferation measures depends on the attitudes and policies of many supplier nations.

Fortunately, a generally shared perception of the risks of proliferation and the need for effective non-proliferation policies is developing among the major suppliers, and some significant steps have already been taken to coordinate common policies. Soon after entry into force of the NPT, which was, of course, the first major multinational step toward international supplier responsibility in the nuclear field, the U.S. and several other principal supplier states undertook discussions looking toward agreement on specific items of materials and equipment on which in the case of exports to NNWS, they would require IAEA safeguards and the recipients' assurance that such items would not be used for any nuclear explosives, with the stipulation that the same restrictions would apply in case of retransfers to third countries. Agreement on a list of items, such as reactors and fuel reprocessing and fabrication plants, was reached in 1974.

Since then the U.S. has continued to explore the development of common policies with other supplier nations. General awareness of the need for such policies was reflected in the final Declaration of the NPT Review Conference, which urged that "In all achievable ways, common export requirements relating to safeguards be strengthened, in particular by extending the application of safeguards to all peaceful nuclear activities in importing states not party to the Treaty." Secretary Kissinger, in his September 22 address to the U.N. General Assembly, emphasized the need for efforts among supplier states to strengthen and standardize safeguards and controls on the export of nuclear materials.

In the ongoing discussions in which the U.S. and other principal suppliers are engaged, each nation must consider and assess a number of factors in light of its own interests and perspectives. These factors include policies for sharing technology with others, competition for markets, and the risk that too many or too rigid restrictions may drive countries to develop indigenous and unsafeguarded nuclear capabilities. Different countries may give different weights to these factors, making it difficult to achieve complete unanimity on proposed non-proliferation policies. I would like to emphasize, however, that today all other principal suppliers, like the U.S., intend to require IAEA safeguards on nuclear transfers to NNWS. We know of no contemplated transfer to a NNWS on which the supplier will not require these safeguards. This could, in effect, result in safeguarding the entire nuclear programs of recipient countries if all future nuclear facilities and materials are simply not available for export without safeguards. I am also pleased to note that progress has been made in dealing with the problems related to technology transfer, and specifically to the need for assuring safeguards on facilities constructed through the use of supplied technology.

Two recent agreements of other countries have included provisions that any facilities constructed in the recipient nations through the use of supplied technology will be subject to IAEA safeguards.

The need for common supply policies is clearly recognized in paragraphs 3 and 4 of the proposed concurrent resolution H. Con. Res. 371. We concur as to the desirability of the goals reflected in those paragraphs, i.e., comprehensive IAEA safeguards as a condition of supply and a requirement that reprocessing be performed in properly protected regional facilities under international safeguards. This is a goal we are striving to attain through the continuing, step-by-step discussions with other supplier nations. As I have indicated, the task of working out common policies is a complex one involving, as it does, many nations, which, while sharing a concern about the risks of proliferation, may approach the problem with different attitudes and policies. Nevertheless, the solutions to the problem must be found on the basis of agreement among the supplier nations, as is recognized in the proposed resolution, and requires patient and continuing negotiations.

Mr. ZABLOCKI. Thank you, gentlemen. We certainly appreciate your excellent statements and your kind remarks regarding House Concurrent Resolution 371.

I would like to ask some questions of you gentlemen as a team.

I note that all of you have referred to adequate verification.

Earlier witnesses have made suggestions relative to the language on page 2 of the House Concurrent Resolution 371, the reference in paragraph 2 of the resolved clause where it states:

> The Congress of the United States urges a comprehensive agreement ending underground nuclear explosions under adequate verifications if all nuclear weapon states will enter into such agreement.

COMMENTS ON SECTION 2 SOLICITED

A prior witness stated it would not be necessary to include the phrase "under adequate verification." He also urged that perhaps the United States ought to end underground nuclear explosion on a unilateral basis and, therefore, not have any reference as to "if all nuclear weapon states will enter into such agreement."

Would any of you gentlemen wish to comment on the observation and recommendation that we delete that language on lines 19 and 20, page 2? Would that be desirable or undesirable, productive or counterproductive?

Ambassador **Tape.** Mr. Chairman, if you will permit——

Mr. **Zablocki.** Ambassador Tape.

Ambassador **Tape.** Let me respond to your question more as a citizen than as the U.S. representative to the IAEA. From my own experience in matters like this, I believe that we would not be wise to enter into agreements of this kind without full mutual types of verification.

NEED FOR FULL MUTUAL TYPES OF VERIFICATION

I personally feel that, if those who have the responsibility, determine that a comprehensive agreement prohibiting underground nuclear explosions is in the U.S. best interest, then I certainly think we must look at mutuality for the parties that are involved. I, for one, would not delete the requirement for adequate verification.

I would also perhaps note that we are talking about explosions, here, which could be either of a military nature or a peaceful application nature. I will remind the committee that there are certain provisions in the Non-Proliferation Treaty that say that any advantages accruing from the utilization of peaceful nuclear explosions shall be made available to the non-nuclear-weapon states.

The IAEA—and I will come back to IAEA—has been requested to be the Agency which would oversee such applications if they should prove to be worthwhile. In such cases, there is very strong indication that international verification would be required. Such tests or applications must be peaceful, and I don't know how that can be verified without being pretty close to and involved with the project.

Mr. **Zablocki.** I assume that the other gentlemen agree.

Mr. **Sievering.** Yes, sir. I would like to associate myself with Ambassador Tape's remarks.

OBSERVATIONS MADE BY PREVIOUS WITNESS

Mr. **Zablocki.** An earlier witness from Eximbank stated that the Bank is very much aware of the problem of nuclear nonproliferation and is sympathetic to the concerns of this committee and our colleagues, both in the House and the Senate, as expressed in the various statements and proposed legislation. Nevertheless, in the Bank's view, the proposed concurrent resolution would not be in the best interest of the United States. I suppose their view is based on the view that the business of exporting nuclear reactors is necessary to enhance our trade, and they don't see the dangers of proliferation or the use of plutonium for military purposes.

I don't detect any such attitude on the part of our witnesses today, that the resolution before us is not in the best interest of the United States.

Mr. **Kennedy.** Not from my testimony, sir.

Ambassador **Tape.** I would have to understand the basis for that statement, and offhand I don't see what the basis would be, unless it is the question of economic competition amongst suppliers.

Mr. Zablocki. Essentially that is the basis.

Ambassador Tape. But your resolution has included in it a caveat having to do with all suppliers agreeing to such, which would seem to me then tends to equalize this question of competition.

Mr. Zablocki. Prior witnesses have also called attention to the provision in section 3. Particularly my question relates to page 3 of the House version on line 7, where we would urge a halt on further transfers of nuclear fuel, technology, and equipment to any country which has not accepted International Atomic Energy Agency safeguards on all its nuclear programs or which by January 1975, has not become a party to the Treaty for Non-Proliferation of Nuclear Weapons.

DEADLINE FOR COMPLIANCE TERMED TOO SHORT

The testimony stated that this was too short a time for nations to comply. Would it be preferable to amend the resolution to specify January 1977, giving an additional year? I invite your comments on that proposal.

Ambassador Tape. Mr. Chairman, I think you have raised a good point and I probably should have spoken to that earlier. As a practical matter, there is no additional meeting of the Board of Governors of IAEA scheduled for 1975; the last meeting was held in September. The next scheduled meeting is February 1976. I think it is important to give countries time to respond.

Mr. Zablocki. The concurrent resolution would not become law. It is an advisory request or suggestion. As a practical matter, I think we better——

Ambassador Tape. Even those who are proceeding along this line now would not be able to have the safeguards agreements looked at before 1976.

Mr. Zablocki. If I may ask one further question, I believe you gentlemen have a copy of Senate Concurrent Resolution 69, which, I must advise, was as a result of our concurrent resolution, and the Senate has built upon it. Of course, I believe to some extent they at least think they have improved it, and I think there was some improvement in their version.

VIEWS ON SENATE ADDITION AIRED

Specifically I want to call your attention to section 5, in the operative section of the concurrent resolution on page 3, beginning with line 21, where they provide that, "the Congress of the United States urges a halt in the production of weapons grade material for weapons use under adequate verification system. Following implementation of this provision, the Congress further urges, in order to share American nuclear resources and to guarantee nuclear fuel as needed to satisfy the legitimate energy needs of participating countries," et cetera.

Do you believe this is a worthwhile recommendation which the House should include in its version?

Mr. KENNEDY. Mr. Chairman, I would have to say that it would be inappropriate, I think, for a regulatory commission to comment on a matter of this magnitude in terms of its possible defense and security implications. I simply don't know what those considerations may be. I don't know what the weapons situation is.

If in fact this could affect, as I think it might, negotiations, for examples, in SALT and other arms control areas, I think that such considerations should be looked at very carefully before a judgment is rendered on this proposal.

Therefore, I could not make a judgment at this juncture.

Mr. ZABLOCKI. I raise the question because both Mr. Sievering and Ambassador Tape have referred—quoting from Ambassador Tape:

> We should never be so inflexible that in achieving the goal for the majority of nations we drive a small number of important states to the development of their own unsafeguarded nuclear capabilities.

UNITED STATES AS CREDITABLE SUPPLIER

Mr. SIEVERING. Without commenting on the words there, there is a theme here that I would like to comment on, and that is the availability of nuclear fuel. I think this is an area in which the United States, which has been the principal supplier and a leader in the furnishing of that fuel, at this juncture has stopped from lack of capacity. This is one of the very important things that the United States has done and continues to do in furthering its nonproliferation objectives, and it is now necessary for the United States to reestablish itself as a creditable, dependable supplier of fuel, nuclear fuel, for power reactors, which, I think, is very much in support of our nonproliferation agreements.

Ambassador TAPE. I would agree with the statements of both Commissioner Kennedy and Mr. Sievering. Mr. Chairman, my first reading of Senate Concurrent Resolution 69 is just now, I am sorry to say. In my opinion the words there don't convey what Mr. Sievering is trying to get across. By that, I mean he is saying we should address the question of the United States providing a source of adequate fuel, and I don't read this language in quite the same way.

DIFFICULTIES WITH SENATE LANGUAGE

I think that this requires a lot of study. The language in the Senate version, in effect starts, as Commissioner Kennedy said, by saying, in a sense, that we can at this time stop all production of weapons grade material. That means to me uranium and plutonium. I don't think that is the issue here. It is uranium we are talking about.

There is also a question of ultilization of enrichment plants for supplying material for fuel in submarines. I don't know where that fits in. In other words, I think there are a number of questions that the drafters perhaps haven't looked at carefully.

Mr. KENNEDY. Let me add, Mr. Chairman, I would endorse the views which Mr. Sievering has expressed. I personally feel that it is in our own interest and it is in the interest of the nonproliferation policy we have long espoused that we be a reliable supplier of fuel. Else, others are going to look elsewhere for fuel or develop their own capabilities for producing it.

Mr. ZABLOCKI. Being a reliable supplier of fuel raises a question. For how long can we be a reliable supplier of fuel to other countries?

Mr. SIEVERING. You mean in terms of resources available worldwide?

UNITED STATES AS RELIABLE SUPPLIER OF FUEL

Mr. ZABLOCKI. Available through the United States and worldwide, of course.

Mr. SIEVERING. The way it normally operates, to answer your question, is that we have the facilities capable of doing this, and the normal course of events is that those wanting enriched fuel bring the natural uranium to us for enriching, so it is not the United States having control over the natural resources of the world. But it is true that we have major efforts on today to discover more natural uranium on a worldwide basis. It is a material that may be in short supply.

Mr. ZABLOCKI. Thank you very much. Mr. Findley.

NONMILITARY FACILITIES UNDER IAEA SAFEGUARDS

Mr. FINDLEY. Mr. Chairman, I would like to ask Ambassador Tape—and the others, if they would like to respond—to give the pros and cons on the desirability of bringing all U.S. nonmilitary nuclear facilities under IAEA safeguards.

They are not now under such safeguards. What are the pros and cons of taking that step at this point? This sort of policy was advanced at one time by President Johnson.

Ambassador TAPE. From a practical point of view, Mr. Findley, I think it is important and useful that all of the facilities be under a common set of safeguards, that these be international, and, having set up the system that is working, they be safeguards by IAEA.

Let me interject here for a moment that we, in addressing House Concurrent Resolution 371, are talking about facilities under NPT, which means all of the country's facilities. We are also addressing the question of a country unilaterally placing all of its facilities under safeguards.

There is still a third category, and that is that the country's facilities may all be under IAEA safeguards, but under what we call trilateral agreements. Take Japan in which there is a United States-Japan-IAEA agreement, a United Kingdom-Japan-IAEA agreement and several others, so that for practical purposes, all of Japan's facilities may be under IAEA safeguards, but it is created out of a mosaic of agreements than under one overall agreement.

Now, the advantages of the NPT come about from the commitment that not only those facilities in being to date are under safeguards, but a commitment that future facilities will come under safeguards, also.

AGREEMENT STRUCTURED TO INCLUDE TECHNOLOGY TRANSFER

If the unilateral agreement could be so structured that it would include technology transfer which Mr. Sievering has said has been an important addition in a couple of cases recently, or if there is a commitment for all future facilities to come under safeguards, we would have protection against the development of some unsafeguarded isolated capability of their own. The difficulty with a system of trilaterals, which may in many cases add up to the equivalent of full fuel cycle safeguards is that there is always the possibility that some little effort might be started independently and not be subject to safeguards. This, for example, is the situation in India, where certain facilities are under safeguards and others are not. This is some thing we wish to avoid.

So I think the thrust is in the direction of your resolution. Whether we get there in one step or whether we work our way toward it, I think it part of the difficulty.

Mr. **Findley**. How do you come out on the pros and cons yourself? Do you recommend that we take some further steps to place all the U.S. facilities under safeguards?

Ambassador **Tape**. You are now referring to the U.S. facilities.

Mr. **Findley**. That is right.

Ambassador **Tape**. I was talking about non-nuclear-weapon states.

Mr. **Findley**. I am talking about United States.

Ambassador **Tape**. With respect to the nuclear weapon states, as a practical matter, we are not buying very much with the expense of the safeguards' operation because we already have a weapons program, we already have capabilities. Division of a few kilograms of plutonium or even 50 kilograms is of no great importance for a weapon state that has a fairly sizable program. On the other hand, questions have been raised as to what some countries would call equity. In other words, country *x* has all of its facilities under safeguards; what about the United States?

UNITED STATES WILLING TO PUT FACILITIES UNDER SAFEGUARDS

I think you know that there was a voluntary offer made by President Johnson and it has been endorsed by subsequent presidents, Presidents Nixon and Ford, that at the time that the major nations, non-nuclear-weapons nations, had placed their programs under safeguards, the United States will offer to place its facilities under safeguards. This is now in the negotiating and drafting stage with the IAEA. We are trying to develop an acceptable agreement.

Mr. **Findley**. At the time President Johnson made that offer, Italy, Germany, and Japan were being encourage to sign an NPT, and, since then, all but Japan has. The Japanese Diet seems to be somewhat restive on it. Might not an initiative on our part help to stimulate some movement in this regard?

Ambassador **Tape**. That is a political question which I cannot answer. I can say that I believe that our own Government has taken every reasonable initiative to help them overcome that restive feeling. For example——

Mr. **Findley**. The disadvantage you see to this is expense?

FULL SAFEGUARDS COMPLIANCE MIGHT REQUIRE SIZABLE FRACTION OF BUDGET

Ambassador **Tape**. Let me amplify a bit with respect to the U.S. offer. If every U.S. facility went under full safeguards in the context that a non-nuclear-weapon state's facilities went under safeguards, it would probably take a sizable fraction of the Agency's safeguards budget to do it.

On the other hand, those nations such as the ones you identified were more concerned with the question of access to proprietary or company confidential type information by virtue of inspectors being present in the plant, or the question of cost, if there is a cost differential by virtue of our facilities not being under IAEA safeguards and those that are, that they wanted some equity, either in cost, nuisance, or whatever.

NRC ALSO APPLIES EXTENSIVE SAFEGUARDS REQUIREMENT

Now, let us not forget that the U.S. Nuclear Regulatory Commission has a very extensive safeguards requirement on our U.S. facilities and we are only talking about the next level of IAEA or international safeguards. From the discussions we have had with these nations I think most of them are interested in that the Agency would receive records, reports, and so on that come out of our national system, which is the same kind of burden that they would have, and that there be an opportunity or possibility of inspection, but not necessarily inspection on each and every facility as to whether the Agency would elect to put say 100 U.S. reactors under safeguards, I find the concerned nations are not that interested that all 100 should be under safeguards at all times. It may be that perhaps a dozen would be under full safeguards at any one time, whereas all 100 would be part of the system.

Mr. FINDLEY. So the offer on our part might not lead to substantial additional expense?

Ambassador TAPE. It will undoubtedly lead to some, but in my view, Mr. Findley, it is not substantial. I think the other nations of the world are not interested in a large burden to the Agency or others. They would like, however, to see us exposed in the same way they are.

I might add that the United Kingdom is doing as we have done, has made this offer. The Soviets have not and, of course, the other two nuclear weapons powers, France and China, are not parties to the NPT and have not participated.

HOW REQUIREMENTS OF LAW ARE MET

Mr. FINDLEY. Mr. Chairman, I have one question that I would like to present to Mr. Kennedy and Mr. Sievering. Both of you stated that you are required by law to determine that the proposed export not be inimical to the common defense and security.

Could you take us through a few typical cases and show us how you meet that requirement of law? Take Taiwan or Spain or India or Mexico.

How would you go about determining whether or not a proposed sale is inimical to national security and common defense?

Mr. KENNEDY. I will be glad to tell you what some of the considerations are. We would ask of the executive branch—and many of the questions would ultimately be routed through State. We certainly would want to be sure that there is in fact an agreement for cooperation and that that agreement for cooperation reflects the appropriate safeguarding requirements.

We would more particularly try to be sure, depending on the nature of the facility, that physical security arrangements would be adequate and adequate not necessarily in terms of our specific requirements, but adequate in terms of utilization of the situation in the country itself, how it conducts its normal policing affairs.

Mr. FINDLEY. Do you look into the physical security of other nuclear facilities within the country that are now presently safeguarded?

Mr. KENNEDY. I think an examination of those would have been made by U.S. personnel. Now, it would not be in any sense inspecting. They would be consulting with the country involved to get an appreciation of the way they go about their physical security activities.

CONSULTATION WITH RESPECT TO DEFICIENCIES

Mr. FINDLEY. Would the absence of what we would deem adequate security at one of these facilities be sufficient to cause our Government to reject the proposal?

Mr. KENNEDY. I would think not. It would probably raise questions about the facility in question.

Mr. SIEVERING. We would be consulting with them and we would be advising them where we think these deficiencies are in regard to the kind of material, and the kinds of facilities that it is going to be used in.

Mr. FINDLEY. How about the other facilities that may not be directly related to this proposal? Do you look in at the safeguarding that goes on at facilities within that country? Is that a part of your checklist?

Mr. SIEVERING. We look at the facilities in which the material will be used or is destined to be used. If it is going to be fabricated and then used at another facility, we look at where that material is going to be.

Mr. FINDLEY. Do I conclude that you do not look at the total picture of safeguards policies within the country to which the order is proposed?

Mr. KENNEDY. Yes, indeed, sir.

Mr. SIEVERING. Yes, we do.

Mr. FINDLEY. To what——

CONCERN IS ALSO ONE OF ACCOUNTABILITY

Mr. KENNEDY. I was going to add, sir, if I might, in that connection, that while we spoke of physical security, we also are concerned about materials accountability, which is the IAEA safeguards arrangement.

Either there would be absolute adherence. We want to know whether the country is an adherent to the NPT. In any event, we would wish to know whether the country was or was not prepared to place the activities concerned under IAEA safeguards. There would be a requirement alternatively that there be an absolutely tight bilateral arrangement. Preferably in most cases I think it is both a bilateral arrangement and an arrangement with the IAEA, so it turns out to be a trilateral agreement.

These are the types of consideration we look into. As well, we ask for a general assessment from the executive branch of the recipient country's intentions on the proliferation questions, as we understand them. For example we would consider any public statements it may have made; programs it may have had which may imply movement toward weapons or other explosive programs and the nature of those programs; and whether in fact adequate safeguards can be assured. That is the nature of the statements that appear.

It is that sort of process that underlies the decision from our perspective. Much of it depends, of course, as it must, upon data that has to be developed through the foreign affairs and defense communities.

NRC HAS VETO POWER

Mr. ZABLOCKI. Will you yield? To what extent is the procedure that you have outlined interrupted or made more difficult to follow if, for example, the executive branch or the President makes an offer of a nuclear reactor to a given country for instance, in the case of Egypt and Israel?

Mr. KENNEDY. It makes it more interesting, sir, not necessarily more difficult.

Mr. FINDLEY. It makes it easier, doesn't it? [Laughter.]

Mr. KENNEDY. No, sir, it does not. Not for us.

Mr. ZABLOCKI. Do you have a final say so, a veto on the license, regardless of who makes the offer?

Mr. KENNEDY. Yes, sir.

Mr. ZABLOCKI. That is comforting.

Mr. KENNEDY. Let me add, however, if I may, sir, that when we say "yes", at least that is precisely correct in our judgment. We think the laws are clear. I would not comment on whether it is appropriate that an independent regulatory agency be empowered with a veto on a matter which may have foreign policy implications.

Nonetheless, it is our understanding that that is the law. So long as it is, you can be sure that we will carry it out to the fullest of our ability.

Mr. FINDLEY. Do you look to the administration to balance out the political factors or do you attempt to do that yourself?

NRC RELIES ON ADMINISTRATION FOR POLITICAL JUDGMENTS

Mr. KENNEDY. I think it is some of both. We obviously are not in the political assessment business. We must rely to a very considerable extent upon the judgments they make. However, in the process as it has evolved, we ask questions in order that we can be satisfied that they have in fact examined all of the issues which might raise questions before we come to an ultimate judgment of our own.

Mr. FINDLEY. Do you routinely ask the Department of State and DOD and National Security for a political evaluation?

Mr. KENNEDY. That is part of the whole process, yes sir.

Mr. FINDLEY. That is a routine checklist? How about ACDA?

Mr. KENNEDY. It is not a routine checklist. Let me explain exactly how it works. As I indicated, the focal point of this effort in the executive branch, from our perspective, is the Secretary of State, simply because we wished to work with the authority in the executive branch who can speak or is normally empowered to speak for the executive branch in foreign policy matters. On the major issues of foreign affairs, it clearly is the Secretary of State.

However, the Secretary of State, it is my understanding also queries and involves in the process of developing the answers, ACDA, the Defense Department if the circumstances warrant as they almost always do, and ERDA.

State also, I am sure, involves to the appropriate extent considerations from the intelligence community.

Mr. FINDLEY. But you routinely look just to the Department of State for a response on political factors?

Mr. SIEVERING. They are the coordinator of the total executive side.

ADMINISTRATION ASSESSMENTS TAKEN INTO ACCOUNT

Mr. KENNEDY. We are essentially aware, sir, at the staff level through staff liaison, of the views of the agencies. We do not interfere in their process. It would be inappropriate for us to do so. But we are aware of what is going on in the process in the effort to make certain that, as the case evolves—as their own thinking and their own judgments and assessment are being made—that they are aware of questions which we will have, questions which we believe we must resolve in our own minds as a basis for ultimate judgment. Thus as I was going to add earlier, although we certainly do have, in our judgment—though my colleagues from the executive branch of Government would probably have a somewhat different view on this. We do have from our perspective the full authority, if necessary, to veto a request for license, no matter at what level it originates——

Mr. FINDLEY. But in terms——

Mr. KENNEDY. We would not, hopefully, ever be faced with that situation.

Mr. FINDLEY. In terms of procedure, do you always ask at least the State Department for an evaluation of political factors?

EXECUTIVE ASKED FOR EVALUATION OF POLITICAL FACTORS

Mr. KENNEDY. Yes, sir. We ask for the executive branch's evaluation of political factors.

Mr. FINDLEY. Where does that request go?

Mr. KENNEDY. To the Secretary of State.

Mr. FINDLEY. Do you routinely advise the liaison officers at DOD and ACDA that this is being done or not?

Mr. KENNEDY. By arrangement—by agreement with all parties, at the same time we write the letter to the Secretary of State, we forward a copy of that letter to Mr. Ikle in ACDA, to the Assistant Secretary of Defense, ISA, and to Mr. Sievering. I believe it is normal to send a letter to Mr. Sievering for Mr. Seamans.

Mr. FINDLEY. Thank you.

Mr. SIEVERING. I only want to make two points. I think it should become clear from what Commissioner Kennedy has said that at the end of this process, in which the State Department is the coordinator of the executive position that also brings into it the foreign policy implications and others bring in intelligence and defense and national security considerations, that they have then essentially culled the available information and thinking that went into that decision whether it was a Presidential offer or anything else.

I also would share Commissioner Kennedy's view that I think reasonable people having that same information will in effect come to the same conclusion.

On the other hand, I would take issue at this particular moment that it is as clear, as some would like to state it, that the independent regulatory agency has in fact a veto over a Presidential foreign policy decision.

STATE'S RESPONSE IS A SYNTHESIS FROM OTHER DEPARTMENTS

Mr. **Findley.** Commissioner Kennedy, the response that you get from the Secretary of State—would it, without exception, make reference to the reaction of these other departments and agencies?

Mr. **Kennedy.** Not necessarily, sir. It would synthesize them in normal cases, giving us the sum, I think, of the judgments and views of the departments and agencies.

Mr. **Findley.** I see.

Mr. **Zablocki.** Does OMB enter into it?

Mr. **Kennedy.** Not that I am aware of, nor is it routine. I would suggest, sir, if you would find it helpful, that you might want to pursue the procedural aspects further with Mr. Kratzer, who I understand will be before the committee at some later date.

My understanding is that, should there be a significant difference of view on the matter among the executive agencies—for example, should ACDA and State have a major difference or ERDA or State feel differently from one another, or something of this sort arose which was not resolved—that the resolution would be brought before the Under Secretary's Committee of the National Security Council, and, if necessary, then forwarded for the views of the President to make the recommendations and the views of the executive branch known to the Commission.

VETO SITUATION NEED NOT ARISE

I would add, if I may, sir, one other point. While it is true, as I have said, in our judgment, that we have this veto, I see no reason at this juncture why a situation which would cause this sort of visualized confrontation need ever arise.

First, I think the executive branch is well aware throughout the process of the things that genuinely concern us. I would suspect that, if it appeared—I can't speak for the executive branch in this regard—but if it appeared that those concerns could not be alleviated, could not be eliminated, in the process, that in most instances the problem would not be brought before us. I think that is the first consideration.

Second, I think it should be noted that as to the basic views on nonproliferation—the basic policies of this Government, there is no difference between the Commission's view and the view of the Government, the executive branch. We both strongly adhere to all the principals of nonproliferation policy.

Mr. Findley. Thank you.

Mr. Bingham. Thank you, Mr. Chairman. Mr. Sievering, would you give us your comments on the export by West Germany and Brazil—the agreement to export extensive nuclear equipment and technology, including, as I understand it, to some degree reprocessing facility technology?

BACKGROUND ON WEST GERMANY-BRAZIL DEAL

Mr. Sievering. Certainly, Mr. Congressman. I think you really want to go back a little bit into the origins and I think we can say very clearly that we would have preferred that the effort of the Germans in opening up there two areas of reprocessing and uranium enrichment in Brazil would not have occurred. The record, I think, is clear and it has been so stated before that we did have discussions at the diplomatic level on the wisdom of this move by the Germans.

On the other hand, I think, if we then step back one further step and look at it from the Brazilian side as to what they were seeking in terms of some self-sufficiency in their energy programs and then look at what Germany was able to negotiate, I think it doesn't turn out to be all as black as it has on occasion been painted.

By that, I mean that what Germany has done has been to place all of its transactions under this agreement under IAEA safeguards through the trilateral that is being executed between Brazil, Germany, and IAEA.

This is one of the countries I referred to in my prepared statement that has moved another step further in additional restraints, and that is in the field of technology transfer.

AGREEMENT PROVIDES PREVENTION OF DUPLICATION

In effect, what they have now is that whatever technology, whatever equipment they furnish on the enrichment plant or the small reprocessing plant that is contemplated, that the Brazilians cannot take that technology, they cannot reverse engineer it, they cannot take the blueprints, et cetera, and build another plant outside of safeguards—the safeguards will now follow that technology.

So whereas, you can question the wisdom at this particular stage as to whether Brazil should have access to enrichment capacity of its own, whether it should have reprocessing capacity of its own, in effect the Germans have, through their agreement, prevented that particular technology from being duplicated outside of safeguards.

As I was attempting to indicate in my prepared statement—and Ambassador Tape was also referring to that possibility—if you can come to some common policies among the suppliers, then even though there is a series of trilaterals here, which happens to fit into the perceptions of Brazil the Non-Proliferation Treaty, you can, in effect, if you have this technology transfer provision, end up by placing the entire Brazilian program under IAEA safeguards.

Mr. Bingham. Before I go on, would either of the other two gentlemen like to comment on the Germany-Brazil situation?

Ambassador TAPE. I have nothing to add to what Mr. Sievering has said.

NEED FOR GENUINE SUPPLIERS' AGREEMENT

Mr. KENNEDY. I would have nothing more to add, sir, except that I too would share the view that there is a further indication of the need to move to genuine suppliers' agreement.

Mr. BINGHAM. All right. Now, how do we achieve that? What pressures do we have to achieve that? As I understand it—and correct me if I am wrong—Germany is completely dependent on us today for the supply of nuclear fuel. Is that correct?

Mr. SIEVERING. I believe that is correct. It can purchase from the Soviet Union, but a large measure of its nuclear fuels, a significantly high percentage, does come from the United States.

Mr. BINGHAM. That is in the form of enriched fuel, I take it, which we may have processed, but which might have come from other sources.

What if we were to withhold that as a means of bringing pressure to bear in a case like this?

Mr. SIEVERING. Well, I think there are two ways of looking at it. One is to put into balance—and I think this is a question more appropriately addressed to the Department of State—as to how important this particular issue is, how important it is within a broader spectrum of relationships between the countries, and what we are sacrificing vis-a-vis that.

WITHHOLDING FUEL COULD BE DETRIMENTAL

I think frankly, sir, from a general nonproliferation standpoint, the signal that would go out around the world with that kind of action—in my view, would only reinforce the desires in other countries that:

> What we have to be is self-sufficient. We have to have our own enrichment plant. We can't have our supply cut off and shot up and down like a yoyo.

They would read our action his way because it would be very much counter to the environment and atmosphere and policies of the U.S. Government which it has followed since the beginning.

I was mentioning before to Chairman Zablocki on the question of supply of fuel that that has been a very significant nonproliferation tool. I think to take the kinds of actions such as withholding fuel to get them to stop something that we have found at the moment unpalatable, would be a very serious blow to the general concepts.

Ambassador TAPE. I would take a very strong position to oppose any such leverage or cutoff. In my statement, I said:

> Let us remember that the objective here is non-proliferation, and let us not be so inflexible that we drive some countries to creating their own indigenous capability.

I cannot prove my scenario, but I think, if we were to do that with the Germans and they then decided they could not go forward with the Brazil arrangement because of the impact of our cutoff on the German economy, Brazil then would have to make some judgment of how it could meet its needs. To continue the scenario, Brazil has already in its own judgment decided it couldn't rely on the United States because we couldn't meet their needs for enriched material.

Now in using certain U.S. leverage to cut off other suppliers they have, I am afraid they would be shopping with far less concern of nonproliferation and their own behavior in the future.

BRAZIL HAS CAPABILITIES FOR DEVELOPMENT

So, coming back to what Mr. Sievering was saying, if one looks at the totality of our objectives, we probably are much better off under the circumstances than if we had gone the other route. Brazil does have indigenous materials; it does have capacity, which in time, it can develop.

Mr. BINGHAM. Is it our view that it is premature for them to develop reprocessing facilities? I have noticed in one of your statements that there really isn't any civilian reprocessing go-on yet anyway.

Ambassador TAPE. For immediate need of large reprocessing for civilian power, I think it is a bit premature. However, what one must look at is that, not unlike ourselves, most of these countries wish to have certain indigenous capabilities, certain technology. They don't want to be at the mercy of other people. The argument has been used that "even if we do get into a major regional reprocessing arrangement, we would like to have our people be technically competent. We want to participate as equals, so we need to get started." It is not an unreasonable argument, although one can argue to what extent they have to get started and how big the plant has to be for educational purposes. That is another reason why I believe that, if we would take initiatives with some of these countries, to work with them, we might be able to satisfy some of their immediate needs and still get to the larger plants downstream. But that takes an initiative on the part of the supplier.

PREVENTING TECHNOLOGY FROM REPLICATION

We could interpret the FRG-Brazilian arrangement to the effect that the Germans are protecting themselves and the rest of us by virtue of the arrangements that Mr. Sievering has outlined; that is, protecting the technology from being replicated at a future date outside of safeguards.

Mr. KENNEDY. My own view, sir, is that though the idea has some attraction, the problem would be that since this is not a monopolistic situation any longer, we would be actually encouraging the more rapid development of and bringing more enrichment and fuel fabrication facilities on line.

I think more people would be moving more quickly and would be encouraged if they saw us doing this—shutting off major customers, as it were. There would be others, I feel sure, who would speed their efforts to get into the business to take advantage of this.

Mr. BINGHAM. In this connection, during these hearings, I think somebody has said that the techniques of nuclear power production outside the United States tend to use a lower level of enrichment in the uranium field, is that correct?

Mr. SIEVERING. I don't think that is correct, sir. The two largest competitors to the United States in supplying reactors—France and Germany—are furnishing essentially the same reactor.

ROLE OF CONGRESS IN AGREEMENTS FOR COOPERATION

Mr. BINGHAM. Mr. Kennedy, you referred to the procedures that were adopted, I think, under last year's act providing that an agreement for cooperation is submitted to the Congress, and the Congress may disapprove by concurrent resolution within 60 days.

Do you know how many agreements have been submitted under that procedure to date?

Mr. KENNEDY. I do not know, sir. I believe that the particular provision predates the Energy Reorganization Act. I think is was 1974. I can't recall.

Mr. BINGHAM. I don't think so. Not as I recall the debate. There was a requirement for filing. I don't think there was any requirement or procedure for disapproval by concurrent resolution. I might be wrong on that.

Mr. KENNEDY. It is my understanding that this was required beginning in 1974.

Mr. BINGHAM. The filing, yes.

Mr. SIEVERING. The Joint Committee has to report out to the Congress in 30 days. The Congress has 30 days to act by way of concurrent resolution.

Mr. BINGHAM. Well, perhaps I should rephrase my question then. Approximately how many such agreements have been submitted to the Congress for action one way or another? A large number?

NUMBER OF PAST AGREEMENTS SUBMITTED TO CONGRESS

Mr. SIEVERING. Well, over the span of years, we have had some 30 agreements for cooperation, approximately. This new amendment put in these two 30-day periods. We can check this for the record, but we think only the extension of the research reactor agreement with Israel has gone through that procedure.

Mr. BINGHAM. But then there is a new procedure.

Mr. SIEVERING. A new procedure resulted—well——

Mr. KENNEDY. I think it was the summer of 1974.

Ambassador TAPE. I think you are right.

Mr. BINGHAM. That is what I thought, and that is what I was referring to.

Mr. SIEVERING. That is the one that has the two 30-day periods.

Mr. BINGHAM. Now, getting to this matter of the condition in the language of our draft that all other major nuclear suppliers agree to a similar halt, you have indicated that you approve of that condition, but do you approve it on the understanding that it also applies to France and China?

DISTINCTION MADE ON VOLUNTARY PLACEMENT UNDER SAFEGUARDS

Ambassador TAPE. No, no, no. I was simply arguing earlier with respect to the voluntary offer of our facilities being placed under safeguards. This is where it came up. That we and the United Kingdom have volunteered that we would do this. The Soviet Union has not volunteered. We are the only three nuclear weapon states parties to the NPT. I am not talking about suppliers, but nuclear weapon states, parties to the treaty, so that was another issue, if that is where you made the distinction.

Now, this one—"suppliers" to me has to do with just that—namely, suppliers—countries who are in the market of selling reactors, other nuclear facilities, or major components.

Mr. BINGHAM. Well, I guess what I am getting at is that it seems to me there is a difference between doing something unilaterally, on the one hand, and doing something in conjunction with, say, Britain and the Soviet Union, as a second possibility, and, third, waiting until everybody is willing to do it, including China and France. China and France haven't cooperated in any of this.

Isn't it wholly unreasonable to expect them to come along with any of these proposals? Do you follow me?

Mr. SIEVERING. Could you clarify, sir? Are you referring to article II of your resolution or are you referring to article III of your resolution?

Mr. BINGHAM. Let us look at article II. I think that is a clearer case, which is for a comprehensive agreement ending underground nuclear explosions.

Now, we have an agreement that we won't have atmospheric explosions, but France and China have never entered into that, so, to that extent, they are already out.

Now, I am suggesting that it would be unreasonable to propose a condition for extending that to a complete ban on the condition that they come along, since they haven't even come as far as we have come to date.

MEANING OF AGREEMENT ON CESSATION OF TESTING

Ambassador TAPE. The major difference is that in agreeing to the Limited Test Ban Treaty, we did not agree to cessation of all weapons testing, but, if one extends this now to all testing anywhere, then it means that the parties which would agree to it will have accepted the cessation of any weapons testing.

I think here you might find the security interests would have a somewhat different view on leaving France and China outside some such arrangements as that, whereas the present arrangement does not call for a cessation of weapons testing in the United States or the United Kingdom or France.

Mr. BINGHAM. But surely we have been negotiating, have we not, for such a total cessation, and arguments back and forth about verification and so forth. Our negotiations, I presume, have been on the assumption that we would go ahead with the Soviet Union and the British.

Ambassador TAPE. I am out of that field, so I can't answer.

Mr. SIEVERING. I think you have probably three disqualified witnesses, sir, on that issue.

PARAGRAPH 3 AND ITS EFFECT ON CHINA AND FRANCE

Mr. BINGHAM. Let us look at No. 3 then, which has the same type of a condition. I understood you to express general agreement with paragraph 3.

My question would be: Do you intend—is it your understanding that this would not have any effect if China and France were not to agree to a similar halt on transfer? I don't know if they qualify as major nuclear suppliers, but they are in the nuclear business.

Mr. KENNEDY. France certainly would qualify.

Mr. SIEVERING. China has not in any way, to my knowledge, entered the market in any major way, but certainly we would consider France as a major nuclear supplier.

Mr. BINGHAM. So this would apply then to France, not necessarily China.

Ambassador TAPE. You might be interested, sir, that the second safeguards agreement Mr. Sievering referred to on technology transfer triggering future facilities being placed under safeguards had to do with a French-South Korea-IAEA agreement for reprocessing. Although we have had this impression about the French, I think one must take their new action as perhaps some kind of an indication that the French are as serious about some of these matters as we are.

Mr. BINGHAM. Would you develop that thought a little bit? Tell us a little bit more about that agreement?

FRENCH-SOUTH KOREAN AGREEMENT DETAILED

Mr. SIEVERING. This is generally the same as the one with the Germans and Brazil. What France is saying—and here you have an NPT partner, Korea—and France has added an additional restraint above and beyond that required by the Non-Proliferation Treaty with a treaty party; namely to, "if and when we transfer to you this chemical reprocessing plant," which is a small one along the lines that Ambassador Tape was describing, "that technology—you cannot iterate that into another plant unless it be under safeguards." So, if by some remote chance South Korea were to decide that the Non-Proliferation Treaty, for one reason or another, is no longer in effect, France has a restraint on that technology being iterated as an unsafeguarded plant.

Mr. BINGHAM. One final question having to do generally with the IAEA. Ambassador Tape, my impression is that IAEA, among the various specialized agencies of the United Nations has been relatively freed from the politicizing decisions. They haven't been plagued with the tensions of the Middle East, for example.

Is this correct?

IAEA: PLAGUED WITH POLITICIZING DECISIONS?

Ambassador TAPE. That is true, and we are trying to maintain that situation. I believe in part it has been true because we have a rather well-defined what I call technical type of thrust. The debate tends to be in the technical and energy areas.

At the same time, I have to say that at the General Conference in September, a month ago, we had some rumblings of these things, such as questions about whether the PLO should be admitted as observors. There was behind-the-scenes type consultation and so on. The question did not arise in the General Conference itself.

There was an initiative by certain nations to try to in effect remove South Africa from its Board's seat, the Board of Governors. This, by virtue of the statute and procedures, is essentially impossible, although it could have produced debate in the General Conference, the point here being that South Africa is one of the more technologically developed and also has a considerable program of production and export of nuclear materals. Their designation on the Board comes by the Board itself designating them as one of the most advanced.

The outcome was a certain number of members wrote to the President of the General Conference expressing their unhappiness with South Africa's Board membership; the President of the General Conference then brought this to the attention of all members of the Agency.

MEMBERSHIP OF THE GENERAL CONFERENCE

I think, in general, members of the Agency take pride in that, but, given the way of life these days, I am not sure how long this will continue.

Mr. BINGHAM. The General Conference, I presume, goes on a one-state, one-vote basis?

Ambassador TAPE. Yes. It is one state, one vote.

Mr. BINGHAM. What Middle Eastern states are members?

Ambassador TAPE. Essentially all of them; the only exceptions are Bahrain, Oman, and the two Yemens.

Mr. BINGHAM. They are not a signer of the NPT.

Ambassador TAPE. I may make the point that there are two separate entities—one parties to the NPT and the other members of the IAEA. One of the things we have to bear in mind is that the IAEA works for the members, but, also that the Agency has been given responsibilities by, for example, the NPT, namely that the Agency is the appropriate body for the of administration of international safeguards under the NPT.

The NPT Review Conference in May in its declaration stated that in the opinion of the Conference, the IAEA is the appropriate body to continue to assist in making PNE services available. This would include assisting in feasibility studies and possible future participation in an international inspection of the peaceful nuclear explosions programs.

TREATY CALLS FOR 5-YEAR REVEIW

So there are activities that are being done on behalf of all nations, others on behalf of members.

Mr. BINGHAM. Does the NPT have any continuing organization of its own or is it just——

Ambassador TAPE. Not as a continuing organization, but in the original treaty there was an article which called for a review after 5 years, and that is the meeting I referred to. There will be a similar one called for in the future.

Mr. BINBHAM. I think that is all I have. Thank you.

Mr. ZABLOCKI. I might state that I had the privilege of visiting the IAEA headquarters and was very impressed with what you are doing in so small a place.

Ambassador TAPE. Thank you.

Mr. ZABLOCKI. What is the total IAEA budget. You said it was some direct and some voluntary. What part does the United States provide?

IAEA BUDGET AND U.S. CONTRIBUTIONS

Ambassador TAPE. For the current year 1975, the regular budget is $32.2 million and the target for the voluntary fund is $4.5 million. Because of specific contributions and other income, the assessments for 1975 totaled $26.5 million of which the U.S. share is $7.5 million or 27.9 percent. The United States is contributing $1.106 million in cash toward the voluntary fund; in addition, $1.394 million of assistance in kind—fellowships, experts, equipment—is being provided.

We remind you that the Congress did a few years ago set a 25-percent ceiling for U.S. participation in international organizations, but it was at that time that Congress realized also that there were some special situations with respect to the IAEA, and this ceiling was not made mandatory. We have been trying hard to meet the intent of moving toward 25 percent as new members join the Agency and as opportunities for reduction take place. Also I have to remind you there is in the calculation of assessments a two-step process; one covers all costs other than safeguards and then a second covering safeguards costs. This was done specifically to try to ease the burden on some of those small countries that aren't really involved in nuclear programs as yet. Without safeguards the U.S. fraction is 27.7 percent and with safeguards included it is 27.9 percent.

Mr. ZABLOCKI. The IAEA safeguards program does not include physical protection or prevention of sabotage. Now, assuming an added staff and an additional budget, would it be desirable to expand IAEA's activities to cover those areas, Mr. Ambassador?

Ambassador TAPE. Mr. Chairman, I would say "no" as far as the present time is concerned.

Mr. ZABLOCKI. What international agency could go into this area?

IAEA'S INVOLVEMENT IN PROTECTION AND SABOTAGE PREVENTION NOT ADVISABLE

Ambassador TAPE. Let me expand. The Agency is involved in providing advice, recommendations, guidelines, et cetera, at the international level, as both Mr. Sievering and I have pointed out. Guidelines first issued in 1972, have been updated and issued this past September. ("The Physical Protection of Nuclear Material"—INFCIRC/225.)

These are available to all nations by way of guidance. In my view, physical security is so much tied up with the internal domestic security affairs of the nation that I find it quite difficult to really visualize an international body that would take over that type of activity.

We faced up to this a few years ago, and I think a good decision on the part of the U.S. Government was to initiate bilateral discussions. In the General Conference of a year ago, the head of the U.S. delegation offered to all members to undertake bilateral discussions of the subject of physical security, ERDA and others have followed up. The bilateral discussions and the ability of our people to get into other countries and for those from the other countries to see what we are doing has really paid off.

It may be that there should be some kind of an international convention, as has been suggested, where all nations would get together and agree on certain international standards, of one sort or another. This may be worthwhile. And the Agency is examining this to ascertain what might be included at such a convention.

BILATERAL APPROACH SEEN AS EXCELLENT

But let me warn you that one of the dangers of international conventions is the long delay before coming into force. Everybody says: "Fine. I won't do anything until it is finished," and 5 years later maybe we have a convention with 8 or 10 signatories. In the meantime we have lost considerable ground. So, to me, the bilateral approach, as we have been doing, is an excellent approach to achieve the objective. To do these other things as they come along, fine, but let us not forgo the immediate benefits.

Mr. **Zablocki.** A very important factor in preventing sabotage in communication of intelligence. Now, what agency would provide the intelligence on sabotage? Would you care to comment?

Mr. **Sievering.** I am not quite sure I can comment on who would provide the intelligence.

Mr. **Zablocki.** After all, if you are going to prevent sabotage, you need some intelligence input. What international agency is equipped to do that?

Mr. **Sievering.** I don't think there is any.

Mr. **Zablocki.** Interpol?

SEARCH FOR AN INTERNATIONAL AGENCY TO PREVENT SABOTAGE

Mr. **Sievering.** That is a possibility, but it is something that you have, whether it is in this field or another field, but I think you are going to have to largely depend on the interrelationships that exist among national police forces and among national intelligence forces, that are expanded in scope to take into account these possibilities.

We now have at the technical level some exchange of ideas, showing other states how we are going about it, visiting their facilities and learning how they are going about it. This has been very, very well received.

There is a wide range of concern and desire on the part of the national governments to really employ the best methods for their concerns against subnational groups or terrorism or sabotage.

As Ambassador Tape said seeking some convention, I think also, will slow down this process that right now is going on.

Mr. **Zablocki.** Mr. Ambassador, on page 10 you have dealt with the regional fuel cycle centers. When do you expect that the IAEA regional nuclear fuel cycle study now underway will be completed?

Ambassador **Tape.** The Agency is seeking assistance from those nations that have the capability to have inputs and to participate right now. The program has already started; the major effort will be during 1976. There will be several stages for which there will be progress reports.

Whether or not a final report can be finished by the end of 1976, I am not sure. It is on the order of a year to 18 months.

PROGRESS REPORTS STILL IN EARLY STAGES

Mr. ZABLOCKI. Are there any preliminary conclusions that they have reached which you can share with us?

Ambassador TAPE. No conclusions as yet. It is in the earlier stages. The preliminary study by the Agency, which was undertaken some months ago, was first of all to look at whether or not this had sufficient merit to even undertake a study of this kind. Those were very fruitful.

This study, by the way, is not just a technical study. There are other questions—Mr. Sievering in his testimony noted the question of organization. How do governments get together? Where are the centers to be sited? A lot of legal and sociological, as well as technical and economic, questions exist.

Mr. ZABLOCKI. In other words, you are just laying the groundwork?

Ambassador TAPE. It is groundwork and the early phase of setting up the modeling studies. I have to point out a regional center in one region of the world may have a quite different set of input data, timing, and so on, than one in another.

Look at Europe, at Africa, at Latin America, at the Far East; they present quite different requirements and conditions.

Mr. ZABLOCKI. Now we will pursue the question that you had asked, Mr. Bingham; and that is: Short of denying a supplier fuel, as in the case of Germany, what other pressures do we have if a country is not living up to the standards that are set?

RANGE OF PRESSURES BROUGHT TO BEAR

Mr. KENNEDY. I think, Mr. Chairman, that there is a range of pressures that can be brought to bear. These are matters which perhaps witnesses from the Department of State would wish to discuss here.

Obviously there is a range of pressures, if that is the word, political encouragements which are brought to bear. One's relationships are involved, therefore, and it is a significant issue.

Mr. ZABLOCKI. If I may ask, in the colloquy earlier, you said that you did exercise the veto——

Mr. KENNEDY. Sir, I said that we had the authority to do so.

Mr. ZABLOCKI. How many times have you exercised it?

Mr. KENNEDY. We have not exercised that veto, sir.

Mr. ZABLOCKI. What percentage of applications has your Agency approved?

Mr. KENNEDY. What percentage of applications, sir?

Mr. ZABLOCKI. In other words, you may not have vetoed. But they may have been approved. How many have been withheld? You can supply that for the record.

Mr. KENNEDY. Yes, sir, I will supply that for the record.

[The data subsequently provided for the record follows:]

The U.S. Nuclear Regulatory Commission has received 240 nuclear export license applications since its creation on January 19, 1975. It has issued 125 export licenses based on these applications. None of these applications has been turned down. The following is a breakdown by major category.

NUCLEAR EXPORT LICENSE APPLICATIONS RECEIVED AND LICENSES ISSUED BY NRC SINCE JAN. 19, 1975

[As of Nov. 4, 1975]

	Applications received since Jan. 19, 1975	Licenses issued by NRC based on applications received since Jan. 19, 1975	Licenses issued based on applications received prior to Jan. 19, 1975	Applications received prior to Jan. 19, 1975, and still pending
Major source material [1]	6	3	3	0
Major special nuclear material [2]	56	18	12	2
Facilities [3]	7	0	1	2
All other [4]	171	104	9	6
Total	240	125	25	10

[1] Major source material.—Quantities of source material (unenriched uranium or thorium) greater than 10,000 kg.

[2] Major special nuclear material.—Quantities of special nuclear material (enriched uranium, plutonium) greater than 1 effective kilogram.

[3] Facilities.—This category encompasses both production facilities and utilization facilities as defined in sec. 11 of the Atomic Energy Act (facilities determined to be capable of the production or use of significant quantities of special nuclear material). All of the above export license applications were for nuclear reactors (utilization facilities), either research reactors or commercial power reactors.

[4] All other.—Small quantities of source material, special nuclear material and byproduct material used in such items as pacemakers, neutron sources, research samples, fission counters, industrial gauges, etc.

Mr. ZABLOCKI. I would like to turn to Ambassador Tape. The gentlemen before us have referred to the importance of cooperation among the supplier states. Why is that cooperation not now more forthcoming and what can we do to generate it? Also are the London suppliers' conference meetings promising in this regard?

COOPERATION AMONG SUPPLIER STATES FORTHCOMING?

Ambassador TAPE. Let me start and then ask the others to continue. I haven't been a party to the London conference negotiations or discussions. Mr. Sievering in his testimony referred to some earlier work on the part of suppliers. There was in Vienna over a period of several years discussions on the conditions that would trigger the requirement for IAEA safeguards before a supplier would export to a non-NPT party. These were not under the aegis of the Agency per se. But by virtue of the fact that various countries have missions in Vienna it means that we have there a common interest in matters relating to the Agency, nonproliferation and so on.

After considerable time and debate a list was developed of equipments, components, reactors, et cetera, and of materials, which a supplier country would not export unless the receiving country employed IAEA safeguards. Then having agreed to that list which would trigger safeguards the participating nations wrote letters to the International Atomic Energy Agency, advising that they would not export except under the specified conditions. Other countries followed with similar statements. It was an initial thrust and a start of cooperation among these suppliers. The trigger list did not go as far as many would have liked. But I think a very, very constructive start took place.

There were a few difficulties. The Soviet Union, for example, was not a direct party in the Vienna discussion. On the other hand by the time the discussions were concluded the Soviet Union had been sufficiently advised that they indicated agreement, and so they wrote a similar letter, as did some of the Eastern bloc countries.

COOPERATION SEEN AS "OFF TO A GOOD START"

France was not a party to the Vienna discussions, in part because the objective was to try to discharge an obligation under the NPT. France, not being a party to the NPT, believed it inappropriate to be directly involved.

I think the outcome was that it was an excellent start. It helped considerably, especially by pointing up the next steps namely getting the major suppliers together and addressing some of the questions that were not solved in the first round. I will stop there.

Mr. SIEVERING. You will appreciate, I am sure, Mr. Chairman, that there is great sensitivity in ongoing talks among the London suppliers' group. As Ambassador Tape says, it is the next step. The fact that the countries have come together, including France and the Soviet Union, is recognition that there is a level of consciousness among the suppliers that additional steps and common policies have to be evolved.

The fact that they have met more than once and more than twice, I think, augers well that there is beginning a sense among the suppliers as to the directions of these policies.

Mr. ZABLOCKI. Mr. Bingham has a question.

Mr. BINGHAM. Some years ago I had occasion to testify before the Joint Committee on Atomic Energy, favoring separation of regulatory aspects of the Atomic Energy Commission from the other aspects. I must say I had a very unfavorable reaction. But that has now come to pass.

My first question would be just in a general way, in your judgment, has it worked?

AEC SEPARATION VIEWED AS ACCOMPLISHING ITS PURPOSE

Mr. KENNEDY. From our perspective, Mr. Bingham, it has worked very well. Needless to say there were a few growing pains at the beginning. But I think it is working very well. It has been able to accomplish the purposes for which it was done.

Mr. SIEVERING. I would very much concur. You are going through growing pains, feeling what territorial boundaries are, et cetera. You would expect this in any kind of a breakout like that.

Mr. BINGHAM. I might say, Ambassador Tape, that I visited the Brookhaven facility and was rather encouraged by the attitude of many of the technicians there. They were not hostile to the idea at all.

That leads to the next question, which is, what about the IAEA? What are the pros and cons of moving toward a similar separation as far as the IAEA is concerned?

SIMILAR SEPARATION FOR IAEA?

Ambassador TAPE. This question has been raised from time to time. My own view on it is that it is a different situation. Although we talk about promotional activities, that is, the activities which seek to bring nuclear energy opportunities to developing nations, the context is much more in making information available in training and education. The Agency is not in the marketplace in the sense of promoting an R. & D. program; it is not like the old AEC coupled with industry.

Also, I tend to believe that there are great benefits from having the technical people working in these other aspects, coupled closely to safeguards, safety and regulatory matters. I believe that the Agency is doing well. But I am sure this question will be raised annually and it will be addressed accordingly.

Mr. BINGHAM. Any other comments on that subject?

Mr. KENNEDY. I would just add a personal observation, sir. While in principle promotional separation makes good sense, in this case, to the extent the Agency does any promotional work it is coupled inherently with the kind of safeguards concern that we are all concerned about. So if you separate it you also may lose that coupling. You may get an intense promotional effort on the one side but not a leavening of concern for safeguards and security that you now get in the Agency.

Ambassador TAPE. The Agency doesn't have to promote nuclear power. The suppliers do a pretty good job.

Mr. SIEVERING. Licensing is a national function. That is where the conflict was beginning to show up in the AEC.

Mr. ZABLOCKI. Congressman Ottinger is with us.

Would you care to ask a question?

Mr. OTTINGER. I was just wondering, in the suppliers conference, is China a member of it?

Mr. SIEVERING. No, sir, it is not.

Mr. OTTINGER. Was she invited?

Mr. SIEVERING. No; it was not. It is not really a major supplier. It is not really even a force in the nuclear commercial market these days.

TESTIMONIES APPLAUDED

Mr. ZABLOCKI. Ambassador Tape, Mr. Kennedy, and Mr. Sievering, we certainly appreciate the time you have given us and the patience you have shown and the direct answers you have provided.

There are a few questions we have that time does not permit us to ask. I wonder if you would agree if the staff would give those questions to you whether you would respond for the record?

Thank you again, gentlemen.

This meeting is adjourned until 10 Tuesday morning, November 4, at which time we will have the nuclear energy private industry point of view. Our witnesses at that meeting will be Mr. Al Bethel of Westinghouse Nuclear Center and Mr. Carl Walske of the Atomic Industry Forum.

The subcommittee will stand adjourned.

Thank you, gentlemen.

[Whereupon, at 4:40 p.m. the subcommittee adjourned, to reconvene at 10 a.m., Tuesday, November 4, 1975.]

[Questions were submitted to Ambassador Tape, Mr. Kennedy, and Mr. Sievering to be answered for the record. The questions together with responses follow:]

RESPONSES BY AMBASSADOR TAPE TO QUESTIONS SUBMITTED BY THE SUBCOMMITTEE

U.S. POLICY TOWARD NPT AND NON-NPT NATIONS

Question 1. An Iranian representative at the IAEA safeguards symposium complained to some U.S. representatives that although Iran has ratified the NPT, the U.S. attitude doesn't appear to give Iran any credit for this ratification in the Iranian desire to instali some 21,000 megawatts of nuclear power within the decade.

(a) To what extent does U.S. policy for nuclear exports and cooperation favor those nations which have ratified the NPT?

Answer. Under U.S. policy for nuclear exports and cooperation, NPT adherence is treated as an important element to be considered in determining U.S. actions in specific cases. Other factors which must be considered include the level of development of a country's nuclear power program, the special sensitivity of certain technologies, regional stability and the country's formal commitment to remain a non-nuclear weapon state.

Just as NPT adherence by itself is not sufficient to justify nuclear exports or cooperation, non-adherence by itself will not necessarily preclude them. Since other countries also supply nuclear facilities, a unilateral U.S. policy of excluding non-NPT parties would not be likely to advance our non-proliferation objectives. If such a policy were adopted, an alternate supplier with less rigorous conditions might well export facilities under terms less sensitive to proliferation dangers than the U.S. could and might be disposed to negotiate. Therefore, the U.S. does seriously consider NPT status, but under current circumstances adherence to the treaty cannot be the sole determinant of U.S. export policy.

Question 1(b). Are NPT and non-NPT nations treated the same?

Answer. Ideally, supplier countries could provide additional incentives to countries to join the Treaty regime by clearly favoring NPT parties in their export policy. To the extent that this is possible and consistent with our over-all non-proliferation objectives we have done so. The U.S. fully endorsed the recommendation, adopted by consensus, of the final declaration of the NPT Review Conference, which stated that:

"The Conference recommends that, in reaching decisions on the provision of equipment, materials, services and scientific and technological information for the peaceful uses of nuclear energy, on concessional and other appropriate financial arrangements and on the furnishing of technical assistance in the nuclear field, including cooperation related to the continuous operation of peaceful nuclear facilities, States Party to the Treaty should give weight to adherence to the Treaty by recipient States. The Conference recommends, in this connection, that any special measures of cooperation to meet the growing needs of developing States Party to the Treaty might include increased and supplementary voluntary aid provided bilaterally or through multilateral channels such as the IAEA's facilities for administering funds-in-trust and gifts-in-kind."

Prior to the conference the U.S. also annnounced its intention of giving a preference to NPT members in the distribution of the contributions-in-kind which it makes to the IAEA.

Question 1(c). If so, why should an uncommitted nation wish to sign the NPT? Or a committed nation remain committed to it?

Answer. States have undoubtedly joined and remained committed to the NPT for a variety of reasons, but we believe the most central is a desire to limit the spread of nuclear weapons. We doubt whether it is either accurate or useful to assume that adherence to the NPT is based upon the incremental economic and tactical advantage that may be realized over non-parties in the export policy of supplier states. Rather, it is based upon the mutual interest of all members in advancing the objective of non-proliferation that sustains the Treaty.

SECRECY IN IAEA AGREEMENTS

Question 2. The basic document for arrangements between a nation and the IAEA for safeguards under the NPT is a public document. However, various supporting documents are secret, which keeps from public view the details of how IAEA safeguards are to be applied in each case.

What can be done to get more information on these agreements into the public view so that the effectiveness of the safeguards can be judged?

Answer. The U.S. Mission to the IAEA has been actively pursuing with the IAEA Inspectorate the possibility of obtaining detailed information for the purpose of increasing public knowledge of actions and findings of the IAEA in implementing its safeguards. Sufficient information is being sought such that, together with an understanding of the IAEA's statutory safeguards objectives and limitations, the public will be able to assess the value of the contribution of

IAEA safeguards toward world peace and security. In responding to this initiative, the IAEA Inspectorate must take into account long-established principles, flowing from the Agency's statute and its basic safeguards documents, which prohibit the Agency from communicating to any state, organization or person any information obtained by it in the implementation of its safeguards agreements. The objective of these principles has been to overcome concerns which had been expressed by many governments that proprietary or commercially sensitive information concerning industrial facilities may be divulged to competitors. IAEA documents setting forth the descriptions of facilities and detailed safeguards procedures and results have therefore been assumed to contain information considered by governments and plant operators as commercially sensitive.

Primarily due to U.S. efforts, the IAEA Director General and Inspector General fully appreciate the importance of the objective of preserving and enhancing public confidence in IAEA safeguards. The Inspectorate has been studying the matter in an effort to identify the type of information which may be released for that purpose, while, at the same time, taking into account legitimate other concerns. The Director General has recently established a Standing Advisory Committee on Safeguards Implementation. We expect him to consult with the Committee on the technical aspects involved. Most likely, the Director General will, in due course, request the Board of Governors to consider policy issues raised during the Inspectorate's study. The U.S. Mission will continue working with the Inspectorate and other elements of the Agency considering this matter in order to encourage the earliest possible and most effective results.

U.S. SUPPORT OF IAEA SAFEGUARDS

Question 3. The Astin panel in 1972 advised the Secretary of State that a weak or marginal safeguards program would probably be worse than no safeguards at all. It also noted that an effective safeguards program requires a fully adequate budget and a strong, highly competent, dedicated staff, together with an effective but modest in-house research program aimed at improving safeguards technology.

(a) What is the U.S. doing to assure the IAEA's safeguards program will be strong enough to grapple with the problems of the nuclear future, particularly if and when plutonium becomes a regular nuclear fuel?

Answer. The U.S. recognizes that as the volume of nuclear materials and the number of facilities grow in the world, commensurate increases and improvements in the international safeguards system will be needed. Accordingly, the U.S. program of support to the IAEA in the safeguards area, which has been under way since the inception of the Agency system in 1958, is being intensified.

An important increase in this program was made possible by the Congress in the Foreign Assistance Act of 1974, which stipulated that a reasonable amount of the $500,000 authorized by that Act for support of the IAEA should be used to strengthen international procedures designed to prevent the unauthorized dissemination or use of nuclear material. Pursuant to this stipulation, $200,000 has been utilized to provide additional safeguards assistance to the Agency.

The U.S. program in support of IAEA safeguards is a coordinated effort involving the Energy Research and Development Administration (ERDA), the Arms Control and Disarmament Agency (ACDA), and the Nuclear Regulatory Commission (NRC), assisted by Government contractors and laboratories and U.S. private firms. ERDA and ACDA maintain close liaison with the IAEA in order to ensure that this effort results in maximum benefit to the Agency's safeguards procedures and effectiveness. Support activities under way include the following:

1. R&D contracts for special studies and hardware development.
2. U.S. participation in specialized IAEA safeguards technical working groups.
3. Developing equipment and devising special exercises to test and strengthen IAEA safeguards.
4. Providing training in special areas of U.S. expertise.
5. Seeking out and nominating highly qualified U.S. professionals for IAEA safeguards staff positions.
6. Making equipment available as gifts or loans.

Further information on actions by the U.S. to strengthen IAEA safeguards procedures is provided in the report on this subject submitted to the Congress by the President on September 3, 1975.

With respect specifically to safeguards implementation if and when plutonium becomes a regular nuclear fuel, ERDA and the NRC are currently studying this matter in the context of U.S. domestic requirements. It is anticipated that as one aspect of U.S. support of the technical effectiveness of IAEA safeguards, a sustained effort will be made to relate to IAEA needs the theory, system and technology planned and developed for domestic application. In addition, the U.S. is providing support for the IAEA study of regional nuclear fuel cycle centers, where the reprocessing, storage, and fabrication of fuel containing plutonium could take place under conditions which would best assure adequate safeguards and physical protection measures.

Question 3(b). What is the present capability of the IAEA to take on safeguards of the Euratom countries?

Answer. In 1973 the IAEA expected that implementation of the Euratom-IAEA agreement pursuant to NPT would begin in late 1974 and its budget provided for additional inspectors to be hired to meet the resulting increased workload. Hiring of all the additional inspectors for that specific purpose has been deferred, pending the coming into force of that agreement. The authorized posts for the Operations Division of the Safeguards Department for CY 1975 include 74 professional and 20 clerical positions. About 69 would be considered to be for full-time inspectors. As of November 3, 1975, 41 full-time inspectors and 18 clericals were actually employed. An additional 14 professionals are expected to join the staff as full-time inspectors during the first quarter of 1976. It should be noted that the IAEA Board of Governors has authorized 70 of the current staff members of the entire Department of Safeguards and Inspection (including the Division of Development) to serve as inspectors. As a matter of practice, however, only professionals in the Division of Operations have served routinely as full-time inspectors. Division of Development personnel have participated in inspections only on an ad hoc basis, usually for specialized purposes, such as testing instruments or developing new techniques.

The 1976 budget for the Agency assumes an increase in the number of facilities to be safeguarded from the 414 predicted in 1975 (including Euratom facilities) to 523 in 1976. (These numbers do not include facilities in the U.S. or U.K.) One new professional (Director-level) position has been established for 1976. The following excerpt from the Agency's budget for 1976 (GC XIX 550, Section N) indicates how the Department is planning to handle the increasing workload:

"Steps have been taken during the last few years to avoid a growth of the inspection effort proportional to the increase in nuclear activities subject to safeguards. This policy will be maintained during the coming period of expansion of nuclear power production and the consequential increase in the nuclear material flow and inventory. It will be implemented by the use of more sophisticated methods and instruments, more intensive preparation and evaluation work at Headquarters, the provision of continuous technical support by the Division of Development and closer managerial control of the safeguards implementation work."

Question 3(c) What would be the implications for the IAEA safeguards program of the U.S. making good on its offer to place the U.S. civil nuclear industry under safeguards? If this is done, how much of the U.S. enrichment capacity would be under IAEA safeguards?

Answer. The impact on IAEA of actually implementing the offer will depend on how many U.S. facilities the IAEA selects for inspection at any given time. In testimony given in hearings on the NPT before the Senate Committee on Foreign Relations, July 10, 11, 12 and 17, 1968 (page 111 of the hearing record) it was noted that "the U.S. offer will be fulfilled by the negotiation of a formal implementing agreement between the IAEA and the U.S. government. That agreement would identify those activities in which the IAEA could apply its safeguards. In implementing the agreement, the IAEA will determine in which of the activities, among those listed, safeguards are to be applied. It is doubtful that the IAEA will wish to apply its safeguards to all activities listed, nor do we believe that the purpose of the U.S. offer would require that it do so. It is more likely that the IAEA would elect to apply safeguards to a representative number of U.S. activities, at least initially."

During subsequent discussions among other governments interested in the U.S. offer, a formula was informally arrived at to meet their concerns whereby the IAEA would be able to select for inspection those U.S. facilities which incorporated advanced technology or were otherwise important in international commercial competition. The draft U.S./IAEA safeguards agreement, as negotiated with the IAEA Secretariat to date. provides that IAEA safeguards (including inspections) will be carried out only at facilities selected by the Director General at any time from among all U.S. facilities eligible under the offer. The Director General may also select from the remaining eligible facilities, those which will be subject to design review, including visits by inspectors to verify design information, and to maintenance of the required records and submission of nuclear material accountability reports to the Agency.

The Director General will consult with the interested governments (including the U.S.) in the course of making his selections. The Board of Governors will in its annual budget recommendations to the General Conference, take into account the Director General's recommendations. Since the U.S. offer was made to meet the concerns of other nations and to support widespread adherence to the NPT, the U.S. has taken the position that the expenses of the IAEA in implementing the offer should be included in the Agency's safeguards budget. After some years of experience with implementation of the U.S. offer, the governments which were most interested in the offer may recognize that safeguards are not, in fact, an element in the ability of their industries to compete with U.S. industry and will wish to reduce the implementation of the U.S. offer.

It should be recognized from the foregoing that the precise impact of the U.S. offer on the Agency is not predictable at this time. In its 1975–80 budget planning document (GC XVIII)/526), the IAEA estimated an initial need for 10 additional inspectors to begin implementation of both the U.S. and the U.K. voluntary offers. A large initial effort will be required to review the designs and prepare the documentation for each of the several hundred eligible U.S. facilities.

The three government owned enrichment plants now operated by ERDA have national security significant and it is not contemplated that they will be included on the list of eligible facilities. Eligibility of any future U.S. enrichment plant will have to be considered on the merits at the time.

THE IAEA AND STATES

Question 4. IAEA safeguards depend fundamentally upon accounting, records and inventories of States with IAEA acting to verify the information. Is this a suitable method for the nuclear future, or should U.S. policy be directed to developing and imposing parallel IAEA accounting within nuclear facilities?

Answer. A separate IAEA safeguards system completely duplicating all aspects of the national system would be expensive for the IAEA, wasteful in total manpower and resources and an excessive intrusion on national sovereignties. As such, it would be unacceptable to plant operators and their governments. Neither does it appear to be necessary, if the IAEA has the continued opportunity to independently verify the data that it receives (through inspections and measurements) and to apply important containment and surveillance techniques to the materials involved.

PHYSICAL SECURITY AND THE IAEA

Question 5. At the IAEA's symposium on safeguards last week in Vienna, Inspector General Rometsch said that the IAEA can support States on setting up their systems of physical protection by providing guidance or technical assistance.

(a) Is this a sufficient role for the IAEA, or should the U.S. seek to modify the international statute that established the IAEA, or modify the NPT, to give the Agency a stronger role?

Answer. The physical protection of nuclear material invokes much stronger concerns about national sovereignty and police powers than does nuclear material accountancy safeguards. The attitude of most (if not all) IAEA members accordingly is that primary responsibility for physical protection is a national matter and that the IAEA should have only a limited role in this area. The possibility of IAEA enforcement of physical protection standards is clearly not acceptable to those member states. Recent consultations by the IAEA legal staff with a number of governments also revealed strong and widespread opposition to any form of IAEA verification of adherence by governments to physical security standards. Even the matter of IAEA giving specific advice in this area, at the request of a member state, is of concern to some governments.

In part this concern stems from a desire to avoid spreading the knowledge of current physical security techniques and equipment to potential terrorists through such activities. The Agency, however, may be able to establish and make available a list of experts in member countries who could give advice in specific areas of physical security.

The general standards published by the Agency in INFCIRC/225 ("The Physical Protection of Nuclear Material") are useful to nations seeking information on the subject and can be used as a basis for international cooperation toward general uniformity in physical protection practices. The Agency would be able, if called upon to do so, to sponsor or assist in the elaboration of a convention or other international cooperative efforts in various aspects of physical protection.

Question 5(b). In his paper, Mr. Rometsch noted that in the control of compliance with the States' regulations on physical protection, the Agency's role is limited to notify informally the State on any inadequacy found in the course of the Agency's verification activity.

Is this sufficient, or should not the IAEA be required to formally report such observations by its inspectors to the United Nations, and to inform the public?

Answer. The Agency has no prescribed role at this time to "control" compliance with States' regulations on physical protection. To the extent that the Agency's inspectors do informally notify a state on inadequacies found in the course of their safeguards inspections, this is done at the inspectors' personal initiative or presumably at the informal request of the state. Inspectors are not instructed, however, in details of current physical protection practices and procedures. In the absence of such training (to which some member states would object), inspectors are unlikely to identify any but the most obvious inadequacies. Thus, it would appear that a prerequisite to any effort to formalize the existing practice or to expand it, would be a decision to increase substantially the capability of the Inspectorate in the subject matter. As noted in the preceding answer, such a decision would be difficult to achieve at this time, given the current attitude of the member states.

SEPARATION VERSUS CONFLUENCE OF IAEA SAFEGUARDS AND ASSISTANCE FUNCTIONS

Question 6. Some analysts have suggested that the safeguards function of the IAEA be separated from it, using as an analogy the separation of the regulatory from the promotional functions of the AEC in the Energy Reorganization Act of 1974. On the other hand, other analysts point to the technical assistance functions of the IAEA as an important "carrot" to get developing countries to ratify the NPT.

The Astin report in 1972 emphasized the latter function, noting that safeguards cannot succeed "without effective complementary programs which develop and disseminate the potential benefits of atomic energy."

What is the U.S. policy position on the separation proposal, and what are the reasons for this position?

Answer. The IAEA is neither a promoter nor a regulator of nuclear energy in the sense in which these terms were used to describe the functions of the AEC. The Agency is authorized to encourage and assist research on the development and practical application of atomic energy for peaceful uses, to provide assistance to its members through the fostering and exchange of information, through training and the provision of experts and by the support of scientific and technological programs in developing countries. However, each nation must make its own nuclear decisions. In establishing a national nuclear program, the IAEA can assist a country in *all* phases, including the proper role of the government in assuring adequate safety and safeguards measures. The separation of functions need not extend beyond the national level itself.

The Astin report emphasized the different stages of nuclear development for developing nations and, as a consequence, their differing interests. The differences are even more pronounced when one compares the nuclear weapons states and non-nuclear weapons states. Simply stated, the Astin report calls for a balanced IAEA program that can meet the needs of nations in different stages of nuclear development. Nuclear development is not just nuclear power; it includes applications in agriculture, medicine, water resources and science generally, fields of concern which in most nations precede the acquisition of nuclear power systems. The IAEA has been responsive to these needs and since the Astin report was issued in 1972 has increased the target for voluntary contributions to Technical Assistance to the developing nations from $3 million to $5.5 million for

1976. Contributions by way of assistance in kind will increase this figure perhaps by as much as $2 million.

Finally, I strongly agree with the specific point in the Astin report to which you referred, namely, that the acceptance of IAEA safeguards is enhanced rather than retarded by enabling the IAEA to carry out positive programs complementary to its safeguards responsibilities.

IAEA INSPECTION REPORTS

Question 7(a). To what extent are reports of IAEA inspectors available to the world public or to other nations?

Answer. IAEA inspector reports are not available to the "world public or to other nations". The Agency's statute, Article VII F, states "In the performance of their duties, the Director General and the staff . . . shall not disclose any industrial secret or other confidential information coming into their knowledge by reason of their official duties for the Agency . . .".

IAEA safeguards agreements, other than those pursuant to the NPT, contain the mandatory provision in INFCIRC/66 Rev. 2, paragraph 13: "In implementing safeguards, the Agency shall take every precaution to protect commercial and industrial secrets. No member of the Agency's staff shall disclose, except to the Director General and to such other members of the staff as the Director General may authorize to have such information by reason of their official duties in connection with safeguards, any commercial or industrial secret or any other confidential information coming to his knowledge by reason of the implementation of safeguards by the Agency." And paragraph 14: "The Agency shall not publish or communicate to any state, organization or person any information obtained by it in connection with the implementation of safeguards, except that:

> (A) Specific information relating to such implementation in a State may be given to the Board and to such Agency staff members as require such knowledge by reason of their official duties in connection with safeguards, but only to the extent necessary for the Agency to fulfill its safeguards responsibilities;
>
> (B) Summarized lists of items being safeguarded by the Agency may be published upon decision of the Board; and
>
> (C) Additional information may be published upon decision of the Board and if all states directly concerned agree."

IAEA safeguards agreements pursuant to the NPT contain the provision in INFCIRC/153, paragraph 5: "The Agency shall take every precaution to protect commercial and industrial secrets and other confidential information coming to its knowledge in the implementation of the agreement. The Agency shall not publish or communicate to any state, organization or person any information obtained by its connection with the implementation of the agreement, except that specific information relating to such implementation in the state may be given to the Board of Governors and to such agency staff members as require such knowledge by reason of their official duties in connection with safeguards, but only to the extent necessary for the Agency to fulfill its responsibilities in implementing the agreement. Summarized information on nuclear material being safeguarded by the Agency under the agreement may be published upon decision of the Board if the states directly concerned agree."

The IAEA has established a system of information security to assure that these obligations are met. An individual government would have legitimate access to information as defined in the foregoing provisions, only if such information is brought to that government's attention by virtue of its membership on the Board of Governors, as a result of an initiative by the Secretariat by the Board. To date, no such information has been provided to or requested by the Board. If the government is not a member of the Board of Governors, no mechanism is provided for the receipt of such information except, presumably, as the Board may inform all members of the Agency.

Question 7(b). What is the rationale for limiting access to them? To what extent would a U.S. policy and push to get publication adversely affect either the NPT or the IAEA?

Answer. The rationale for limiting access to inspection reports is twofold: (1) to protect the commercial interests which many states believe could be compromised by release of the information (e.g., information about measurement uncertainties, process losses, actual plant thruput, etc.) and (2) to enhance the diversion deterrent effect of safeguards by preserving for the Agency the important tactical advantage of concealing from potential diverters the extent of its information and specific inspection plans.

A U.S. policy advocating publication of inspector reports per se would be opposed by many IAEA member governments. Further, it is extremely unlikely that the U.S., even if we decided that release of inspectors' reports were desirable, could enlist the support of sufficient IAEA members to overturn the existing policy, which it was necessary to establish at the very beginning of the concept of international safeguards. It is not clear that release of inspector reports per se would contribute to confidence in IAEA safeguards beyond that which would be achieved with the release of evaluated collective information as discussed in the answer to Question 2.

DEGREE OF ACCESS OF IAEA INSPECTORS

Question 8(a). Do IAEA inspectors have full and total access to all facilities which come under IAEA inspection procedures? If not, please explain the arrangements, whether written or oral, by which such exclusions are made.

Answer. IAEA inspectors do not routinely have full and total access to all facilities which come under IAEA inspector procedures. The IAEA statute provides that safeguards inspectors ". . . shall have access at all times to all places and data and any person . . . as necessary to account for" safeguarded nuclear material. However, during the drafting of the content and structure of NPT safeguards agreements (INFCIRC/153) this general right of access was modified as foreseen in the preamble of the NPT, so that, for routine inspection, the Agency would have access only to the strategic points in the facility which are to be specified in advance in agreed subsidiary arrangements. The agreement further provides that (Paragraph 76(D) of INFCIRC/153) "In the event of the state concluding that any unusual circumstances require extended limitations on access by the Agency, the state and the Agency shall promptly make arrangements with a view to enabling the Agency to discharge its safeguards responsibilities in the light of these limitations. The Director General shall report each such arrangement to the Board." The extent of routine access is specified in detail in the subsidiary arrangements. The significant exclusions are addressed in the Agency's internal analysis of the safeguards problems for each facility under safeguards, i.e., "The Safeguards Implementation Practice (SIP)." Access limitations imposed on inspectors in the field without prior agreement with IAEA would be reported by the inspector to Agency Headquarters in a manner appropriate to the situation.

Question 8(b). To the extent that access is restricted, what implications arise with respect to the confidence we can have in the over-all findings on the possible diversion of nuclear materials?

Answer. In theory, the Agency waives access only in situations where it is convinced it can meet its responsibilities for verifying non-diversion by other methods (e.g., containment, perimeter surveillance, measurements only at "key measurement points", etc.). Thus restrictions on access, per se, do not necessarily preclude effective safeguards. Each case must be evaluated by the IAEA on its own merits. Agency inspectors are presumed to be perceptive and have the skill to identify any anticipated problems caused by access limitations. Such problems should be spelled out in the SIP's and the Inspectorate should take whatever steps it considers necessary, in light of such limitations. The requirement, noted in the foregoing answer, that the Board of Governors be informed, provides an opportunity for governments represented on the Board to question the Secretariat concerning the effectiveness of the arrangements proposed and to call for changes believed to be necessary. There is nothing which would prevent the Board, when it is so informed, from also calling upon the Director General to keep the Board informed concerning the Inspectorate's experience with the arrangement.

RESPONSES BY MR. KENNEDY TO QUESTIONS SUBMITTED BY THE SUBCOMMITTEE

Question 1. Mr. Kennedy, how would you characterize the quality of the data and analyses provided to you by the State Department on these matters of negotiations on Agreements for Cooperation? If there are particular weaknesses, in what area do they occur?

Answer. The State Department does not formally consult NRC on the negotiation of Agreements for Cooperation. Since Agreements for Cooperation are a non-licensing function, that portion of the export control process has remained with the Executive Branch in the division of responsibilities brought about by the Energy Reorganization Act.

The Executive Branch does provide full details as to provisions of the Agreements when they are negotiated and during the licensing process provides background information needed by the NRC for its licensing determinations.

Question 2. In the formulation of the original Agreement for Cooperation, do we pay sufficient attention to the economic rationale for nuclear power in another country? Do we explicitly weigh genuine economic need against other political factors such as political stability, the regional security factors, etc.?

Answer. The Nuclear Regulatory Commission is not involved in formulation or negotiation of Agreements for Cooperation. These are matters for which the State Department and ERDA are responsible.

The NRC, of course, is interested in the nature of these agreements since they contain the basis upon which safeguards will be implemented for U.S. exported material and facilities. NRC's views are made known to the Department of State, ERDA and other agencies concerning the basic considerations which the NRC believes should be taken into account in such agreements.

Question 3. In your view, is the responsibility for decision in the area of nuclear exports now too broadly diffused? If so, what rearrangements would seem to be desirable?

Answer. No, I don't believe that export licensing responsibilities are too broadly diffused at present. These responsibilities are divided between the NRC and Executive Branch agencies to take advantage of their respective expertise. For example, as already indicated, responsibility for Agreements for Cooperation is presently centered in the State Department. Technology exports are a responsibility of ERDA. Exports of nuclear steam supply systems or nuclear fuel require a determination by the NRC for issuance of a license. The coordinated efforts of the Executive Branch assist the NRC to reach its determination.

Overall, this system is relatively new. We expect to learn as it functions whether changes are required. Given the importance of nuclear exports, NRC is keeping its practices and procedures and its relations with other involved agencies under continuing review. It has valuable and productive working relationships with these agencies.

With specific regard to the decisions for which NRC has responsibility we believe there is some merit in the involvement of a number of responsible agencies. This assures that a full range of viewpoints are brought to bear. The present arrangements seem to be working well.

Question 4. We used to argue that it was important to transfer our technology so as to maintain control and leverage. Now we seem to argue (whenever a questionable resupply arises) that we are obligated to go ahead because of our commitment. Haven't we rather reversed our rationales somewhat?

Answer. Accepting responsibilities toward other countries (in this case the responsibility to cooperate in civil nuclear matters) necessarily carries with it both a commitment and an opportunity to exert constructive influence in areas affecting our national interest. These are not separable rationales. Therefore, in assessing issues such as the effect of U.S. civil nuclear cooperation on international safeguards and non-proliferation, U.S. commitments and U.S. influence will be very closely interwoven. Nevertheless, each case must be considered individually on its merits in the context of the specific factors involved.

Question 5. Do we ever approve licenses for reactors or reactor components that would not meet the safety standards we impose upon our own equipment?

Answer. The NRC does not evaluate specifically the health and safety characteristics of the facility to be exported in its review of export applications for production and utilization facilities. Reactors and components exported by U.S. manufacturers, however, are of designs that have been approved for use in the United States. Thus, while the primary responsibility for insuring the health and safety of its citizens must rest with the country where the nuclear facilities are located, NRC through its domestic safety standards and regulatory guides also strongly influences the safety of exported facilities and components. Additionally, NRC has close relations in the safety area with a large number of foreign countries which use U.S. equipment, both through bilateral arrangements with those nations and through NRC support for the IAEA reactor safety program.

Of special note is the fact the NRC contributes personnel support to assist the IAEA in the development of codes of practice and safety guides for nuclear power plants. This IAEA program helps to assure that reactors or reactor components meet stringent safety standards throughout the world.

Question 6. You mentioned that you were required by law to determine that a proposed export would not be "inimical to the common defense and security." Could we possibly take some prominent cases, such as India, Taiwan, Spain, etc., and hear how you specifically reach this determination? In other words, what criteria do you use? Do you consider whether or not a country has a reprocessing capability, or whether it has other nuclear facilities that are factors? Please be as detailed as possible in listing the questions you try to answer and the conclusions you reached in these instances.

Answer. The NRC regards all applications for the export of production or utilization facilities and for significant quantities of special nuclear material to be "prominent" cases in the context of the question. In all of these types of cases the NRC must determine that the export in question would not be "inimical to the common defense and security."

The factors NRC and other involved agencies consider in assessing the "common defense and security" issue were addressed in general terms in my testimony. Answers in the necessary detail are provided by the Department of State for the Executive Branch agencies to a series of basic questions which are set forth below. The State Department's response to those questions provide the essential information the NRC uses to make its determination.

The NRC has found the data and analysis provided by the State Department to support NRC export licensing generally complete and well reasoned. On occasion the NRC has requested additional information and the information has been provided fully and promptly. NRC has developed excellent working level relations with the State Department and other Executive Branch agencies to assure that the Commission's particular concerns are taken into account in the preparation of Executive Branch analyses of export matters.

Only after a thorough review of the data provided, either in response to the basic questions or to additional requests for information by NRC, does the NRC determine whether a particular export would or would not be "inimical to the common defense and security."

The basic questions addressed by the State Department are as follows:

1. What is the purpose for the export?
2. Does the recipient country have an Agreement for Cooperation with the United States under Section 123 of the Atomic Energy Act, as amended? And, if so, is the export in question covered by the Agreement?
3. Has the recipient country accepted and implemented IAEA safeguards and/or other appropriate supplementary bilateral conditions (including, where applicable, understandings regarding re-export).
4. In cases in which the recipient country is not required by the NPT to accept IAEA safeguards, does the recipient country or organization have accounting and inspection procedures such as to assure compliance with the requirements of the relevant U.S. Agreement?
5. Does the recipient country have adequate physical security arrangements to deal with threats of sub-national diversion of significant quantities of nuclear weapon materials (plutonium or highly enriched uranium)?
6. What is the position of the recipient country with regard to non-proliferation (e.g., party to NPT, LANFZ, public statements)?
7. What understandings does the United States have with the recipient country with respect to the use of U.S.-supplied material or equipment to acquire or develop nuclear explosive devices for any purpose, and as to the recipient country's policies and actions as to such development using equipment and material from any source?
8. What other factors are there which bear on the issuance of the export license, such as further U.S. understandings with the recipient country, other supplier countries or interested regional countries?

RESPONSES BY NELSON F. SIEVERING, JR., TO QUESTIONS SUBMITTED BY THE SUBCOMMITTEE

Question 1. In the formulation of the original Agreement for Cooperation, (a) Do we pay sufficient attention to the economic rationale for nuclear power in another country?

Answer. In negotiating Agreements for Cooperation, we take into account the reasonableness of the scope of desired cooperation. This is especially true if a country requests an agreement that will permit the transfer of nuclear power reactors and fuel. We do not specifically undertake a detailed analysis to verify a nation's assessment that it requires nuclear power. However, offices within the State Department which are consulted regarding a proposed agreement include area specialists who are conversant with the country's economic conditions and resources, and who are competent to question proposals to install nuclear power where economic justification appears lacking. Furthermore, we follow and sometimes assist in studies conducted to evaluate the need for nuclear power, such as the IAEA's "Market Survey for Nuclear Power in Developing Countries." If we considered a request for a power agreement unreasonable, we would naturally raise questions and explore the matter further before deciding whether to proceed with agreement negotiations on the basis requested. It should be borne in mind that many countries are increasingly interested in nuclear power not only to meet anticipated increased demand for electricity but also from the viewpoint of conserving available fossil fuels, both indigenous and imported, for other purposes such as transportation, agriculture, and use in petrochemical industries.

In developing a power agreement, we consider a nation's proposed plans for installing nuclear power capacity, in order to be able to set a realistic fuel supply ceiling in the agreement. In this connection, I might mention that often, before negotiation on a power agreement is initiated, there are exchanges of visits and consultations on a country's needs and on the various factors that must be evaluated in choosing energy sources. Through these contracts and/or reports by the U.S. Embassy in the country concerned, we are usually aware that thought is being given to installing nuclear power, and we are familiar with the considerations involved, well before we receive a formal request for a power agreement.

Question 1(b). Do we explicitly weigh genuine economic need against other political factors such as political stability, the regional security factors, etc.?

Answer. The existence of economic need is considered along with other factors, including political stability and regional security, which bear on the question of whether an agreement would be consistent with the national security interests of the U.S. Such factors are predominant in any decision as to whether or not to enter into an agreement and if so, what provisions should be included. In agreement negotiations, major consideration is given to aspects pertinent to U.S. non-proliferation policies, including particularly the country's willingness to agree to IAEA safeguards and other controls we consider essential. In addition to safeguards and other bilateral control provisions routinely incorporated in power agreements to assure that supplied materials and equipment will be used only for peaceful purposes, supplementary controls may be included as appropriate in dealing with uniquely sensitive areas. For example, the U.S. believes that in view of the historical relationship between Egypt and Israel, the introduction of nuclear power in those countries should be attended by additional provisions against use of the supplied items for non-peaceful purposes. Consequently, the proposed agreements with Egypt and Israel would include guarantees by the recipient nations to apply effective physical security measures. and would stipulate that plutonium produced in supplied reactors or fuel would be reprocessed, fabricated and stored outside the recipient nations.

Question 2. We used to argue that it was important to transfer our technology so as to maintain control and leverage. Now we seem to argue (whenever a questionable resupply arises) that we are obligated to go ahead because of our commitment. Haven't we rather reversed our rationale somewhat?

Answer. We believe that U.S. ability and willingness to function as a reliable source of nuclear power equipment and fuels has enabled the U.S. to exercise significant leverage with respect to safeguards requirements and the achievement of related non-proliferation objectives. In order to retain this leverage, we must continue to be a reliable supply source. There are two aspects to this. First, to the extent possible, we must fulfill the commitments already made. And second, I believe we should be as responsive as possible to future reasonable requests for fuel supply for nuclear power plants. If we act responsibly in these ways, I am confident we can continue to play a leading role in the development of supplier agreement on policies in support of nonproliferation.

Question 3. Do we ever approve licenses for reactors or reactor components that would not meet the safety standards we impose upon our own equipment?

Answer. In deliberating whether to recommend approval of an export license application, ERDA does not seek to verify that the items whose export is proposed would meet U.S. safety standards, because reactors and components exported must meet the safety standards imposed by the government of the country where the equipment is to be installed and operated. However, we understand that it is generally the practice for a prospective foreign purchaser to request a U.S. manufacturer to submit a bid based on the design of an existing U.S. reactor, or of a reactor approved for construction in the U.S. This design, of course, would reflect required U.S. safety standards. Furthermore, U.S. companies have established their manufacturing operations and procedures in accordance with codes and standards developed by the industry, which take into account U.S. Government regulations. Even in cases where the foreign customer did not designate a specific U.S. reactor model, we assume that the U.S. manufacturer would adhere to his established standards; deviation from them would be time-consuming and costly and would not be likely, therefore, unless this were necessary to meet higher foreign standards. Finally, it may be noted that the nuclear regulatory bodies and regulations of many countries importing U.S. nuclear power equipment have been modeled on those of the U.S., and consequently are likely to include approximately equivalent safety standards. In this connection, I might mention that the IAEA, with the participation of the U.S. and other countries, is working on codes, standards, and guides on reactor safety. It is hoped that these will become the minimum requirements of all nations insofar as they are applicable to their nuclear power stations.

We believe that the high safety standards followed in the construction of U.S. reactors undoubtedly constitute one of the reasons foreign operators choose to purchase such reactors. We believe also that U.S. industry, in order to maintain its reputation and retain its share of the international reactor supply market—especially now, when other nations are competing strongly in that market—will continue to observe the same high standards in manufacturing reactors and components for export.

Question 4. You mentioned that you were required by law to determine that a proposed export would not be "inimical to the common defense and security." Could we possibly take some prominent cases, such as India, Taiwan, Spain, etc., and hear how you specifically reach this determination? In other words, what criteria do you use? Do you consider whether or not a country has a reprocessing capability, or whether it has other nuclear facilities that are not appropriately safeguarded? How do you structure the political factors? Please be as detailed as possible in listing the questions you try to answer and the conclusions you reached in these instances.

Answer. In considering a proposed nuclear export under an Agreement for Cooperation in Civil Uses, ERDA uses the following procedure:

A. The export application is examined to determine whether the type and quantity of special nuclear material or the nuclear facility proposed for export is covered by the terms of an Agreement for Cooperation and whether the amounts requested are consistent with reasonable requirements.

B. In the case of special nuclear material for which an enrichment supply contract is required, we verify that such a contract exists.

C. The proposed export is reviewed for national policy, security, and economic aspects.

D. A written assurance is then requested from the recipient government confirming that the items to be exported will be accepted under all the terms and conditions of the Agreement for Cooperation and that the proposed recipients are authorized to receive and possess the item proposed for export.

The criteria used in reviewing proposed exports for national policy, security and economic aspects include the following:

A. Whether the applicable Agreement for Cooperation contains appropriate guarantees, safeguards, and other control provisions;

B. Whether the country to which the proposed export will be made is a party to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) and, pursuant thereto, has entered into an agreement with the International Atomic Energy Agency (IAEA) for the application of safeguards to its peaceful nuclear activities;

C. Whether the country to which the proposed export will be made, if not a party to the NPT, will accept IAEA safeguards with respect to the export;

D. The relative significance of the proposed export and availability of comparable supply from other sources;

E. The overall nuclear program of the recipient country including reprocessing capabilities;

F. Recipient country's position with respect to the NPT, if not already a party thereto;

G. Whether the recipient country has other facilities not under IAEA safeguards;

H. In the case of significant quantities of sensitive materials, whether adequate physical security is provided by the recipient country; and

I. Economic aspects for both U.S. balance of trade and recipient country's balance of trade.

These criteria, as appropriate, together with any special factors pertaining to each case, have been considered in our reviews of proposed exports to India, Taiwan, and Spain, and the conclusion has been reached to each case that the export would not be inimical to the common defense and security. All of these countries have initiated nuclear power programs involving the use of U.S. power reactors and fuel. The fuel material required for such reactors is low-enriched uranium, which is not useful for nuclear explosives; and IAEA safeguards are applicable to all nuclear materials and reactors supplied by the U.S. under our Agreements for Cooperation with these nations, and also to all nuclear material produced through the use of such supplied items. With respect to any request to export significant quantities of sensitive nuclear materials, consideration is given, as already indicated, to whether adequate physical security measures will be provided by the recipient country. Physical security teams have already visited Taiwan and India, and one is scheduled to visit Spain.

NUCLEAR PROLIFERATION: FUTURE U.S. FOREIGN POLICY IMPLICATIONS

TUESDAY, NOVEMBER 4, 1975

House of Representatives,
Committee on International Relations,
Subcommittee on International
Security and Scientific Affairs,
Washington, D.C.

The subcommittee met at 10:10 a.m. in room 2255, Rayburn House Office Building, Hon. Clement J. Zablocki (chairman of the subcommittee) presiding.

Mr. Zablocki. The subcommittee will please come to order.

This is the fifth in the subcommittee's current series of hearings on the subject of nuclear proliferation. Our witnesses this morning are Mr. A. L. Bethel, vice president and general manager, Water Reactor Divisions, Westinghouse Electric Corp., and Mr. Carl Walske of the Atomic Industrial Forum. They have kindly agreed to share with us the private industry perspective on this terribly complex and challenging question.

Mr. Bethel, if you will proceed, please, to be followed by Mr. Walske. Questions will then be addressed to both of you as a team.

STATEMENT OF ALBERT L. BETHEL, VICE PRESIDENT AND GENERAL MANAGER, WATER REACTOR DIVISIONS, WESTINGHOUSE ELECTRIC CORP.

Mr. Bethel obtained his B.S. at the U.S. Military Academy in 1944, attended the Naval Post Graduate School until 1949 and received his M.S. in physics from Johns Hopkins University in 1951. He has been with Westinghouse since 1955 in several divisions, including the Atomic Power Laboratory in Pittsburgh; Defense and Space Center; Marine Division, and at the headquarters in Pittsburgh, where he served as director of manufacturing and vice president and general manager, Transformer Division.

Mr. Bethel. Thank you, Mr. Chairman. I am Albert L. Bethel, vice president and general manager, Water Reactor Divisions, Westinghouse Electric Corp. I welcome the opportunity to appear at the invitation of your subcommittee to discuss the problem of nuclear proliferation as it relates to the export of nuclear reactors and related fuel and equipment. I will address myself today to paragraphs 3 and 4 of House Concurrent Resolution 371 as the subcommittee requested.

First let me set the question of the growth of nuclear power abroad in perspective. Internationally the growth rate of nuclear power is steeper than it is in the United States. This year alone, for instance, orders have been placed for 17 nuclear powerplants outside the United States, compared to only 5 here at home. Only 4 of these 17 foreign orders were placed with American suppliers.

Indeed, competing in the overseas nuclear market is extremely difficult. It is a misapprehension to believe that the technological strength of American manufacturers in light water reactors puts us so far ahead that we have an almost monopolistic edge over foreign competition. This was never fully true in the past; it is definitely not true today. We have effective, first-class competition abroad and we have to meet them head to head.

Today the key to continuing American hegemony in the international nuclear market is technological strength plus the ability to provide competitive financing. For example, the United States recently lost an order for a Spanish nuclear plant, primarily because of the better financing that our West German competition offered.

The need for the U.S. nuclear industry to stay competitive and active in the nuclear export business directly affects our ability as a nation to influence the world's approach to solving the problems of nuclear proliferation.

In discussing nuclear nonproliferation, I think we must start with several basic facts, some of which may not be clearly understood in our country.

FACTS TO CONSIDER WHEN DISCUSSING PROLIFERATION

Fact 1: Many countries are nuclear exporters selling a variety of reactor systems. France, Germany, and Canada are the most active at the moment. Japan, Sweden, Britain, and others are not far behind and soon could be entering the export trade as active competitors. The Soviet Union has exported power reactors to several Eastern European states and has provided enrichment services to many nations, including most of those in Western Europe.

Fact 2: Nations will continue to select nuclear power for their electrical generation needs since it is often the most economic and dependable source of energy available to them.

Fact 3: Other nuclear exporting states are engaging in aggressive commercial competition to sell reactors abroad and often impose less control and fewer restrictions on such sales than does the United States. For example, these nations have exported parts of the nuclear fuel cycle which the United States, as a matter of policy, refuses to license for export. They have not insisted, as the United States does in certain instances, on obtaining a practical veto over the importing countries' future reprocessing operations and the commercial use of the plutonium from such reprocessings.

Fact 4: As many countries in this world acquire a significant number of nuclear reactors, it is obvious that they will wish to achieve, at some point, the capability of all or most of the nuclear fuel cycle. Their motives could be various—nationalism, desire to achieve energy independence, ability to make their own commercial decisions without outside veto, concern for developing their technology base and to save money as well as foreign exchange.

THE ROLE OF WESTINGHOUSE CORP. IN REDUCING PROLIFERATION

Westinghouse has continually supported the efforts of the United States and other governments to reduce the danger of nuclear weapons proliferation. We are encouraged that the resolution which this committee is considering recognizes that the principal exporter nations are now meeting and grappling with these issues and that it is essential that they achieve accord if nuclear proliferation is to be contained. As House Concurrent Resolution 371 sets forth, our Government's efforts to secure such a consensus deserves the strong support of the Congress.

There is no room in the world marketplace for varying degrees of fervor on the part of different exporters in the enforcement of sensible measures to secure effective nonproliferation objectives. Also, if there is no agreement on common exporter ground rules to control proliferation, then there is a real threat that even the present mechanisms and institutions will come under increasing attack and lose their effectiveness.

The carefully constructed existing nonproliferation regime, based on the Treaty on Non-Proliferation of Nuclear Weapons and international safeguards carried out by the IAEA, should be the essential basis for any other measures which may be adopted in the future. The NPT was a bargain between the nuclear haves and the have-nots.

QUESTIONS RAISED CONCERNING U.S. FULFILLMENT

The non-nuclear-weapons states agreed to forego consideration of the nuclear weapons option and to place their entire nuclear fuel cycles under safeguards. In exchange for this, the United States and other advanced nuclear states agreed to share with them the benefits of the peaceful atom, including that of nuclear powerplants.

But our Government's recent policies have raised questions in the minds of some parties to the treaty with respect to our fulfillment of this bargain. This has now reached the point where the United States is questioning the issuance of licenses for nuclear reactors for sale to some NPT adherent countries unless they agree to accept what amounts to a perpetual U.S. veto over how and where they do their chemical reprocessing and utilize their plutonium for commercial purposes.

This restriction applies not only to the United States supplied nuclear fuel or equipment but also to that supplied from any and all sources.

These countries are responding to two ways: (1) They are turning to other country suppliers who do not—at least yet—add such additional restrictions to the safeguards and inspection obligations already embodied in the treaty; and (2) they are questioning whether the treaty serves the purpose for which it was intended and for which they ratified it—namely, to give them access to the benefits of nuclear power under controls clearly spelled out in the treaty.

METHODOLOGY SEEN AS DIVERGING FROM INITIAL OBJECTIVES

I am not questioning our Government's objectives. They are valid. But I must be frank in saying that I am questioning our tactics because our methodology does not appear to be achieving the objectives we have set. Many people are convinced that the effect has been exactly opposite to that intended. That is to say, some countries are convinced more than ever before of the political and economic importance of achieving their own fuel cycle capability.

Thus the question is not whether other nations will make decisions to achieve energy independence, to avoid unbearable oil import financial burdens or for other national policy reasons. They will certainly do so, and the United States cannot itself change this trend.

Delay it for a very brief period we might—but at the risk of losing our influence over directing events in a way which would come nearest to achieving the objective of nuclear nonproliferation.

I believe that other nuclear supplier states can be brought to understand and share our basic U.S. objectives to establish common export policies to control the possibility of nuclear weapons proliferation. There may be some differences in approach, in tactics, but not in concern over the basic issues. Quiet diplomacy is needed to achieve a workable framework of unanimity.

SECTION 3 RECEIVES ENDORSEMENT

House Concurrent Resolution 371, which we are discussing, recognizes at the end of paragraph 3 that all major nuclear suppliers must act in concert to assure the universal application of international safeguards as a condition of export of nuclear fuel, technology and equipment.

We support this objective. It will allow international nuclear commerce to develop—as it inevitably will whether or not the United States participates—in a way which will assure reasonable and practical controls and safeguards. There may be maverick states which will try to beat the system but the mere fact of the existence of an effective control system will enable the rational and concerned nations to more effectively meet such challenges.

Mr. Chairman, I wish now to address paragraph 4 of House Concurrent Resolution 371. For some time, publicly and in consultation with the U.S. Government, Westinghouse has supported the development of multinational fuel reprocessing facilities under some form of international and/or multinational safeguards and controls.

The most critical part of the nuclear fuel cycle, reprocessing, requires special assurances that the plutonium produced will be used only for peaceful purposes. In the case of states party to the Nuclear Non-Proliferation Treaty this assurance, to a certain degree, is already achieved through the safeguarding provisions of the treaty; but the concept of regional centers does appear to make economic sense and to provide an added measure of reassurance to the world.

MULTINATIONAL FUEL REPROCESSING CENTERS: OF UTMOST IMPORTANCE

In our experience, we see no opposition to this concept on the part of such potential trading partners as Iran, South Korea, the Philippines and other states which have ratified the NPT.

Although Westinghouse is not engaged in the reprocessing aspect of the fuel cycle, we strongly support a determined effort to secure acceptance of the concept set forth in paragraph 4 of House Concurrent Resolution 371. We believe that regional multinational fuel reprocessing centers are of utmost importance and we are prepared to do all we can to advance this concept.

In closing may I endorse the thrust of House Concurrent Resolution 371, which recognizes (1) the essentiality of international exporter state agreement and common understanding in security sensible and effective nonproliferation measures; (2) the implicit understanding that the United States must stay in the forefront of nuclear trade and technology if we are to maintain our capacity to influence the course of world events; (3) the need to develop regional reprocessing centers operating under adequate controls; and (4) the importance of Non-Proliferation Treaty, which serves as the only durable basis for achieving a rational approach to containing the spread of nuclear weapons.

That concludes my statement.

Mr. Zablocki. Thank you, Mr. Bethel, for your statement and your support of the concurrent resolution.

Mr. Walske, will you proceed, please.

STATEMENT OF CARL WALSKE, PRESIDENT, ATOMIC INDUSTRIAL FORUM, INC.

Mr. Walske is President and Chief Operating Officer of the Atomic Industrial Forum, Inc.

His career in the nuclear field dates back to 1947 and includes positions in research. management and international activities. Most recently he served as principal staff officer and advisor on nuclear matters to four Secretaries of Defense. In this capacity he was also responsible for liaison with the AEC and the Joint Committee on Atomic Energy. He served as Scientific Attaché on the U.S. missions to NATO and the Organization for Economic Cooperation and Development in Paris. Between 1961 and 1962, Mr. Walske was the Scientific Representative of the AEC in the United Kingdom. Prior to that he was with the AEC as the Senior Scientific Advisor on the U.S. delegation to the nuclear test ban conference in Geneva. In the late fifties, he was at Atomics International as Deputy Research Director in charge of the reactor physics and computing groups. Earlier, Mr. Walske was Assistant Theoretical Division Leader at the Los Alamos Scientific Laboratory. He joined the Forum in his present position in June, 1973. Mr. Walske received a B.S. in mathematics from the University of Washington in 1944 and his Ph. D. in theoretical physics from Cornell University in 1951. He is a member of the American Physical Society and the American Nuclear Society.

Mr. Walske. Mr. Chairman and members of the subcommittee, I am pleased to be here today to testify on safeguarding special nuclear material, a subject of concern in House Concurrent Resolution 371, which is before your subcommittee.

The Atomic Industrial Forum, Inc., of which I am president, is a not-for-profit association of some 600 corporate and institutional members in the United States as well as in 25 other countries, all of which share a common interest in the development and application of nuclear energy for peaceful purposes.

Our member organizations represent a broad spectrum of the nuclear industry, including utilities, manufacturing companies, universities, labor unions, professional firms, financial institutions, Government organizations, and other profit and nonprofit entities.

Although the forum does provide a mechanism for determining and articulating the views of our various members, the views I am presenting today are my own and not necessarily those of the forum's members, although most of our members would probably agree with my views.

In forming my views, I am influenced by my experience in safeguarding of special nuclear material and weapons while serving for 7 years as Assistant to the Secretary of Defense for Atomic Energy under Secretaries McNamara, Laird, Clifford and Richardson.

OBJECTIVES OF RESOLUTION RECEIVE ADDITIONAL SUPPORT

House Concurrent Resolution 371 has, among other objectives, the nonproliferation of nuclear weapons and the implementation worldwide of adequate safeguards against criminal diversion of special nuclear materials. Certainly these objectives are commendable and ones which I fully support.

From many discussions with leading members of the nuclear industry, both in the United States and abroad, I can assure you that they also share the concerns of the Congress over the spread of nuclear technology and the safeguarding of special nuclear materials. Likewise Government leaders in the United States and abroad share the same concern.

First I would like to discuss the safeguarding of special nuclear materials against diversion and illicit use by criminals, including terrorists. The nuclear industry in the United States is providing leadership in suggesting measures to combat this threat.

As examples, I have provided to the subcommittee staff a copy of two of my speeches on the subject of safeguards; [1] a report prepared for the Atomic Industrial Forum by E. R. Johnson Associates, Inc., entitled "An Upper Estimate of Safeguards for Handling Plutonium"; [2] a copy of a forum study group report entitled "Technical Options for Plutonium Safeguards"; [3] and a copy of a letter just a week ago from the forum's Committee on Safeguards Policy to the Nuclear Regulatory Commission commenting on the congressionally mandated security agency study.[4]

Recognition of the threat of diversion by terrorists or criminal elements is relatively recent, probably catalized by the terrorist attack at the Munich Olympic games. We have all been shocked by this and other acts of terrorism and violence throughout the world.

A REVIEW OF THE NUCLEAR FUEL CYCLE

As I said earlier, the political and industrial leaders in every country, like those in the United States, are anxious to provide adequate safeguards against the seizure of special nuclear materials by criminal elements.

At this point it might be worthwhile to review the nuclear fuel cycle with you to indicate those areas which are most sensitive to terrorist activity. The uranium fuel now in use in light water reactors is not a target for diversion for terrorists because it cannot be used in that form to make a nuclear explosive device.

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[1] The speeches appear on pp. 402 and 406 of the appendix.

[2] Available on request from the Atomic Industrial Forum, 475 Park Avenue South, New York, N.Y.

[3] The report appears on p. 413 of the appendix.

[4] The letter appears on p. 447 of the appendix.

However, spent fuel from light water power reactors does contain plutonium which is created in the reactor by converting the uranium isotope 238 into plutonium. The amount of plutonium created annually in a typical 1,000 MWe light water reactor is about 600 pounds. When removed from the reactor, the spent fuel is still not in a form that is attractive to terrorists. It is highly radioactive and requires a large, complex chemical reprocessing plant to separate the plutonium from the other elements in the spent fuel.

RECOVERY OF PLUTONIUM AND UNUSED URANIUM

Through reprocessing, the plutonium and unused uranium can be recovered and used again. The uranium and plutonium recovered annually from the spent fuel of a typical light water reactor could reduce uranium raw material requirements by about 40 percent and enrichment requirements by about 30 percent, thus effecting a great economy in our natural energy resources.

The uranium saved per year in such a reactor has the energy equivalent of about 4 million barrels of oil. In addition the management of long-lived radioactive wastes generated in power reactors can be significantly simplified by separating them from the unburned uranium and the plutonium. By concentrating the radioactive wastes, they are, in principal, easier to deal with.

The value of plutonium as a reactor fuel has been recognized but there is also widespread concern in the industry and elsewhere about its unauthorized diversion for the illicit manufacture of a nuclear explosive device. Although there are no industry reprocessing plants operating in the United States today, the industry, working with local, State, and Federal agencies, has nonetheless put into place an extensive physical safeguards system for reactors and such experimental plutonium fuel as does exist.

It is a system that is backed up onsite by trained protection personnel who maintain close liaison with law enforcement agencies.

INDEPTH STUDIES PROVIDE COST-BENEFIT INFORMATION

The forum has conducted indepth studies to provide cost-benefit information on the need for and the merits of increasing the level of safeguards as the amounts of plutonium in the industry increase. In the study which I submitted prepared for the AIF by E. R. Johnson Associates, it was concluded "that improved safeguards are within the reach of existing technology, and the cost of implementing them will be small relative to the gain which is achievable by the use of plutonium cycle.

According to the study the total cost for safeguarding plutonium by extensive, redundant and undoubtedly more than adequate provisions would increase the cost of nuclear generated electricity by only six-tenths of 1 percent.

The United States is taking the lead in improving safeguards for special nuclear materials. However, we are only one of many possible suppliers of nuclear technology and materials in the world and are not in a position at this point to dictate international safeguards against criminal diversion.

In the present situation, with most political and industry leaders united against terrorist activities, it seems to me that the most effective approach to implementing adequate safeguards against criminal elements is through cooperative international efforts, both bilaterally and multilaterally, working with the IAEA or some other appropriate organizational arrangement. The executive branch should be called upon to follow a cooperative path of negotiations with other countries rather than on the basis of a U.S. veto.

NATIONAL PROLIFERATION REQUIRES SAFEGUARDS

The other matter, closely related to criminal diversion, which requires safeguards is that of national proliferation. Mostly such safeguards involve accounting accurately for the whereabouts and usage of civil plutonium and highly enriched uranium which could be diverted by a nation into a nuclear weapons program.

Such safeguards do not directly control the actions of any nation intent on a nuclear weapons program. They do, however, indicate whether or not a nation is using civil nuclear materials for a military program. If a nation has undertaken not to do, then such safeguards can give added assurance to other nations that the undertaking is being observed.

Regional reprocessing and mixed-oxide fabrication facilities under strict multinational safeguards, as advocated in House Concurrent Resolution 371, would give added assurance against nations diverting civil reactor plutonium into a nuclear weapons program.

Similarly such regional centers would be advisable for uranium enrichment facilities. While unauthorized diversion could still occur in a regional center if it were operated by personnel from several countries, such diversion would more easily be revealed.

I might add that, because of the economics of scale in reprocessing nuclear fuel and enriching uranium, it makes good sense commercially to pool capacity.

PRACTICAL APPLICATION OF REGIONAL FACILITIES

Although I support regional enrichment, reprocessing and mixed-oxide fabrication facilities, I have some difficulty with the practical application of this in the real world. In many areas, the countries within a region are politically incompatible, such as Israel and Egypt. The same may be true of Brazil and Argentina.

In other areas, a single country such as Iran would appear to be the only user of the regional facilities. In the Far East there are possibilities but transport over great distances appears necessary. Western Europe might be a likely candidate but it is probably not the main problem.

Waste disposal also presents a difficulty for regional reprocessing facilities. Although it should not be a technical problem, the disposal of high level radioactive wastes has become an emotional issue, so that at least for some time it will probably be necessary to return these wastes to the country of origin.

And finally, inasmuch as regional facilities involve longer transportation routes for separated plutonium, there will be an increased exposure to criminal attack.

In my opinion the development of a nuclear power electrical generating program is not a logical route for a country intent on achieving a nuclear weapon status. Research or test reactors provide a more direct, far less costly and controllable path to nuclear weapons. Most candidate nations have the indigenous capability to do this if they choose. The necessary information is in the open literature. The needed materials can be obtained. The reason why many countries have refrained is for a combination of political, economic, and military factors. It is generally not because other nations have barred their way.

When the United States was in a dominant nuclear position, years ago, it could have dictated the terms of international arrangements. However, the United States chose not to dictate but to proceed by persuasion and leadership.

Through U.S. leadership the treaty on nonproliferation has been implemented and a safeguards system is in being in the International Atomic Energy Agency—IAEA. The controls for which the United States asked are quite effective in those countries which have signed the Non-Proliferation Treaty and have accepted IAEA inspections.

Thank you for the opportunity to appear here today. I would be pleased to answer any questions you may have.

Mr. Zablocki. Thank you, Mr. Walske, for your statement. We will now proceed with questions.

RECENT SALES UNDER AMERICAN LICENSES

Mr. Bethel, on page 2 you comment that American suppliers provided only 4 of the 17 nuclear powerplants outside of the United States contracted for this year. Like you, I regret that loss of business and the resulting deficit in our balance of payments, but is it not true that the 13 sales that we lost were won by foreign suppliers acting under American licenses?

Mr. Bethel. No; that is not quite accurate.

Mr. Zablocki. Are any of the 13 sales under American licenses?

Mr. Bethel. Yes; they are. In fact, I can go through the 13 and explain what are the license relations.

The predominant supplier of those 13 is Kraftwerk Union, in Germany. Kraftwerk Union (KWU) was formed in about 1969 by a merger of nuclear programs by Siemens and by AEG, both German companies.

Up until that time, Siemens had been a licensee of Westinghouse in many areas of heavy electrical apparatus, including nuclear. At the time of the formation of KWU we terminated the license agreement, so since about early 1970, the Siemens input has not come from a U.S. license relationship.

So, all of the reactors KWU is building are not built under U.S. licenses, only the German sale by the BBR Co. is under U.S. license.

The Japanese sale by the Mitsubishi Co. of Japan is under our license. To summarize, the predominant factor in the international marketplace so far this year is not a U.S. licensee.

I would say the next most predominant company in the marketplace is Framatone, of France, a U.S. licensee.

Mr. ZABLOCKI. What percentage of Westinghouse's export business is in the nuclear area?

PERCENTAGES OF WESTINGHOUSE'S NUCLEAR EXPORTS

Mr. BETHEL. I will give an estimate. I would like to refine my estimate and submit some additional information for the record.

Mr. ZABLOCKI. Without objection, let me say that information will be made part of the record.

[The following information supplied for the record contains percentages of Westinghouse nuclear exports:]

Over the recent past, the Westinghouse nuclear export sales have related to total Westinghouse export sales as shown below:

Westinghouse nuclear export sales as a percent of total export sales

Year:	
1971	38
1972	33
1973	19
1974	11
1975 (first 9 months)	24

Mr. BETHEL. I don't know precisely—I don't carry the numbers in my head—but I would estimate probably about 24 percent of the Westinghouse Corp. export business for 9 months of 1975 is in nuclear.

Mr. ZABLOCKI. In the last 5 years, has that percentage increased or decreased?

Mr. BETHEL. Again, I am only hazarding a guess. I would expect that it has probably held about as steady as a percentage of the total corporate export business.

Mr. ZABLOCKI. Westinghouse is not the only U.S. exporter?

Mr. BETHEL. Not at all.

Mr. ZABLOCKI. How do you rate with the other American nuclear exporters?

WESTINGHOUSE'S NUCLEAR EXPORTS ITEMIZED OVER PERIOD 1970–75

Mr. BETHEL. We would like to believe—and I think we can demonstrate—we do a slightly greater volume of business than our closest competitor.

Mr. ZABLOCKI. Of that total of 100 percent, what would you estimate it to be?

Mr. BETHEL. I would say 40 percent.

Mr. ZABLOCKI. The other 60 would be divided among how many other companies or corporations?

Mr. BETHEL. In the United States there are three other effective competitors. There were four others. But the recent announcement by Gulf General Atomic seems to set, at least one of them, in a different category for the moment.

Mr. ZABLOCKI. I would like both of you to comment, if you will. I know DISC—domestic international sales corporations—are subsidiaries of American corporations formed solely for the purpose of export.

NUCLEAR EXPORTS UNDER DISC PROVISION

It is our understanding that they are given special allowances for deferring tax on profit. Do either of you know whether nuclear exports are made under these special arrangements by either Westinghouse or any of the others?

Mr. BETHEL. For Westinghouse, the answer is yes. There is nuclear export under the DISC provision.

Mr. ZABLOCKI. Mr. Walske.

Mr. WALSKE. I don't know.

Mr. ZABLOCKI. Mr. Findley.

Mr. FINDLEY. I would like to ask both of you gentlemen a general question. It wasn't too long ago that the United States had a monopoly in the nuclear power field. Today, we are being pressed very hard by a lot of foreign competitors with or without U.S. licensing privileges.

What has gone wrong or has anything gone wrong?

Mr. BETHEL. First, I have to take some exception to your question. I don't believe the United States ever had a monopoly in nuclear power technology. The Russians clearly have developed nuclear power on their own and have quite an extensive network of generating stations.

The British developed a nuclear power generating capability on their own, using the "Magnox" type reactors, and they have some advanced new reactors which will soon be coming on line. They will soon have some nuclear breeder reactors. The French developed on their own a light water technology. The French also developed on their own a gas-cooled technology, a few of the early units of which are still generating electricity.

FACILITY WITH WHICH COUNTRIES CAN DEVELOP NUCLEAR APPLICATIONS

I think the point is that any technically advanced country—by that I mean a country which has a reasonable caliber of good brains in science and has a well-developed engineering and industrial capability—can develop nuclear applications of all sorts, whether it is weaponry or whether it is reactors for research or reactors for power generation.

I think it becomes in many of these cases a question of economics. Let's take France as an example. France had already developed two different kinds of technology. It was a question of economics as to which way was best for them to meet the real need for a massive nuclear electrical generating program.

I think it is a question of how fast can they do it and how much will it cost if they make a choice to go the license route or to evolve it themselves. I don't think we ever had a true monopoly.

We had a program of building nuclear reactors for power generation simply because of the size of the U.S. power demand, which has been about equal to the demand of the rest of the Western World.

That is what gave us the basis for leadership. What appeared to be a monopoly never really existed.

Mr. FINDLEY. Have we lost our position in the world market in this field in recent years?

Mr. Bethel. Certainly.

Mr. Findley. Why have we lost it?

EXPLANATION FOR U.S. LOSS IN WORLD MARKET

Mr. Bethel. We have lost it because, in my view, the Germans decided when they formed KWU, that they were going to be a world power in nuclear-generating technology. They put in enough resources, far above what the level the German market could justify on an economic basis. They accelerated developments, which they did on their own, to the point where they have now in operation a size of central station generating plant which we will not achieve in this country for another several years.

If they put their minds to it, any first-rate technical country can make the same advances we have made, but it takes dedication of resources to do it.

Mr. Findley. To what extent did the resources of this come from the private sector in Germany?

Mr. Bethel. I don't know a firsthand answer to that in the nuclear area. In some other parts of business I have been in, I was able to learn something about how the Germans share between Government and private financing; it was roughly in the ratio of about 35 to 40 percent Government and the balance from the private sector.

DEVELOPMENT IN GERMANY: RESULT OF PRIVATE OR GOVERNMENT FINANCING?

Mr. Findley. Is it your impression, based on what you know, that the development in Germany has been predominantly a private investment development?

Mr. Bethel. I wouldn't say predominantly. I would say substantially, but in the case of the transformer business, where I do know a little bit about it, the Government would put up the money for the major experimental facilities required and the private sector would finance the program, and the people and materials that went into doing the experiments in those facilities.

Mr. Findley. To what extent has Government subsidy had a role in the development of competition to the U.S. nuclear industry?

Mr. Bethel. I would have to say a substantial extent. I think every foreign country that I rate as a present or potential customer, you can find evidence of several sorts of Government support of it.

Mr. Findley. Mr. Walske, would you comment on those same questions?

Mr. Walske. In some countries, like France, there is a nationalized utility industry. The same in Britain. In cases like those, the subsidy is in effect almost total because the technology has been developed in a Government institution.

At least in the beginning it was in France and entirely has been in Great Britain. The customer is a government customer, the electrical distribution company. Here there is completely a government operation.

In France, and also in the United Kingdom, there is a private industry, but the private industry is sort of subordinate and comes along late in the game and supplies parts and pieces and certain engineering type work.

PRICING OF NUCLEAR TECHNOLOGY OVERSEAS

Mr. FINDLEY. Government involvement doesn't necessarily require a heavy subsidy. Could you comment on the pricing of nuclear technology overseas? Does it involve, in your opinion, substantial government subsidy?

Mr. WALSKE. I think I should let Mr. Bethel do that one.

Mr. BETHEL. You are speaking of export pricing?

Mr. FINDLEY. Yes.

Mr. BETHEL. Let me recite the factors——

Mr. FINDLEY. Are we the price leader?

Mr. BETHEL. Yes; without a doubt. We are the price leader, and we are the price leader because of the volume of business that we do in the nuclear field. The high-volume producer will always be the low-cost producer, and therefore can be the price leader and still make a satisfactory profit.

The rest of the competition who have a smaller volume on which to operate therefore will have higher prices. They must be satisfied with lower profit margins or use other factors to influence the business in their favor.

The major other factor in the international nuclear power market is financing. It is the financing package that the customers will buy. I have had any number of customers tell me we love your plants, we love your technology, we love the way we worked with you before, but if somebody comes in with better financing packages, we will go to them.

Mr. FINDLEY. Is Westinghouse financing these plants and recognizing Exim is not always competitive?

Mr. BETHEL. No; we do not finance the plants. We have financing specialists who will work with the customers and take them to where financing might be. They help put together a financing package, but we do not, as a matter of corporate policy, participate in the financing of projects overseas.

ROLE OF U.S. GOVERNMENT IN FINANCING

Mr. FINDLEY. Are you satisfied with the role of the U.S. Government in serving the financing needs of the nuclear industry?

Mr. BETHEL. There was a refreshing change within the last 3 months or so on the part of the Eximbank in simply announcing to the world the United States was going to be competitive. If we can get all of the necessary support both from the executive branch and here in Congress to sustain that, I will be more than satisfied with the Government support we are getting. But, that was clearly a change in policy within the last few months.

Mr. FINDLEY. Except for state societies, I don't see much of a case for Eximbank financing. Why not use the private institutions to provide financing?

Mr. BETHEL. Because the private institutions simply do not come up with a package that is competitive with the packages that the French or the Germans are offering.

Mr. FINDLEY. One of our witnesses suggested it would be a lot more efficient and realistic if we had a direct subsidy to the producing industry rather than to the financial institution. Do you have any comment on that?

REAL PROBLEM CITED AS SHORT- AND LONG-TERM FINANCING

Mr. BETHEL. I don't think that would answer the customer's problem. The customer's problem is short- and long-term financing. A subsidy to a manufacturer, for example, would enable him to drop the price somewhat, I would say by the amount of the subsidy applied, but I think when you look at that price and you consider the nuclear portion of this plant is a fairly small portion of the total generating station, it doesn't change very much the financing problems the customer faces.

Mr. FINDLEY. I guess my question is if the U.S. industry is the price leader, would it not be prudent to get into the financing more heavily and be able to offer a package that would nevertheless beat the competition because of the price leadership you can establish and maintain on your product?

Why not a little higher product price and absorb some of the problem on financing by that means?

Mr. BETHEL. I am not prepared to give a quick answer to that. It will be a very complicated strategic business decision to embark on the financing.

Mr. FINDLEY. Perhaps we could have the right to expand on that answer in the record, if he sees fit to. Maybe it is too delicate to get into.

[The comments submitted by Mr. Bethel follow:]

COMMENTS ON EXPORT SUBSIDIES

In answer to your question concerning the concept of abolishing Export-Import Bank financing and providing subsidies in some form directly to U.S. exporters, who in turn would assume the financing function, the following comments pertain.

There are several practical concerns which militate against a manufacturer directly financing exports. Some major ones are:

1. A manufacturing company's competence lies in the area of producing and selling its products. If it were required to finance over a long term its export sales, it is essentially taking on the role of a financial institution, a role it is not equipped either organizationally or managerially to handle. Such a role would also seriously disrupt the normal supplier-banker relationship that exists in the United States.

2. A company with large export sales, like Westinghouse, would be required to borrow heavily to cover its financing role. This would result in an unwieldy debt to equity ratio and thereby restrict the ability of a company to borrow money to cover the normal financial needs of a manufacturer, such as expansion of domesic facilities and investment in capital equipment to meet market requirements.

3. Often export sales of one company are a small part of a very large project. For a nuclear power plant the cost of the nuclear steam supply system is generally no more than 15–20% of the total plant cost. Generators, turbines, motors, pumps, valves, and a variety of other ancillary equipment represent in aggregate a larger cost portion and may be supplied by a number of different companies. Since the totality of these purchases must be financed, in the absence of a central financing entity like the Ex-Im Bank, either one company would have to pro-

vide financing for the products of other companies, a clearly unacceptable condition, or each company would have to enter into separate financial agreements with the customer. This could result in negotiating tens to hundreds of different financing vehicles with different interest rates and terms. From purely a practical point of view such a complex task could easily drive a potential customer to a foreign supplier and a simple, single source of financing.

4. An exporter who also finances his exports establishes a dual role vis-a-vis the customer. Being a supplier as well as a banker to the customer creates potentially dangerous conflicts of interest. In the case of major generating equipment which invariably becomes a portion of a nation's basic industrial wealth, an American supplier could become easily entangled in the internal domestic affairs of the foreign government, especially in times of economic difficulty. Such a situation would likely only complicate our own nation's foreign policy dealing with that foreign government. In addition, there may exist anti-trust implications associated with the disclosure to the supplier of information normally only available to a lender.

5. Such an arrangement would inhibit small companies from competing with large integrated corporations. The Ex-Im Bank treats all U.S. companies equally.

6. Increasingly, the focus of U.S. foreign policy has been on matters of trade, and monetary policy and practices between and among nations. Ex-Im Bank, as a component of the federal government, is obviously not immune to the foreign policy interests and goals of the U.S. Government and can provide a valuable mechanism for effectuating that policy as desired. Private industry is neither suited for, competent, nor authorized to pursue U.S. foreign economic policy.

In addition to the practical concerns indicated above, the Ex-Im Bank has been effective in helping to generate thousands of jobs for American workers in contributing to a favorable U.S. balance of trade and in sharing U.S. technological benefits with the other peoples of the world. The Bank, as the law requires, is essentially a lender of last resort providing financing for orders that would otherwise be lost to U.S. manufacturers due to an inability to obtain financing or, as is often the case, financing on terms that are competitive to those being offered by foreign manufacturers (whose financing is supported by their own government's financing programs). Also, it should be noted that the Ex-Im Bank's interest rates must by law reflect the cost of money to the Bank, and the Bank typically finances about 40% of the export sale. If competitive circumstances require, the Bank can go as high as 55% finance, with the remainder financed by commercial sources. Thus, there is already substantial private participation particularly in the financing of U.S. manufacturers' exports.

In conclusion, I wish to again express my support for a vigorous Export-Import Bank operation. To be competitive in the international marketplace, it is necessary to provide a financial vehicle equivalent to that provided by other foreign suppliers' governments. The Ex-Im Bank can provide this financial competitiveness which, in combination with the technological and productive competitiveness of U.S. industry, will result in substantial employment opportunities in the U.S. and the healthy economy for which we all strive.

Mr. Bethel. It is not my impression that financing by KWU, for example, plays a significant role in the attractiveness of the package. I know in the notorious Spanish job that was lost, KWU picked up some of the financing. I don't know how.

COUNTRIES ATTEMPT TO BUILD UP INDIGENOUS CAPABILITY

Mr. Findley. Do either of you gentlemen want to speculate on the future as to whether there may develop a sort of division of labor in this nuclear field with the Japanese specializing in one type facility, the United States in another and so on?

Mr. Walske. I think the trend has been as different countries build up indigenous manufacturing capability that they try to do as much of their work with their domestic resources as they possibly can.

So, rather than a trend based on dividing up according to reactor types—after all, light water reactors are predominant all over the world. I have forgotten the percentage, but it is very, very high.

I think the division would be in the other direction, the division of each country doing as much of its work internally as possible.

Mr. BETHEL. I agree with that.

Mr. FINDLEY. In view of the projected energy needs of the United States, as well as other countries, and assuming that sites for nuclear powerplants can be approved, do you expect your industry to rely more heavily on domestic demand than on foreign demand in the years ahead?

RELYING MORE ON THE DOMESTIC MARKET

Mr. BETHEL. We certainly expect and hope that the domestic market is going to come back. We have built facilities——

Mr. FINDLEY. Has it just about dropped out of sight in recent years?

Mr. BETHEL. Not out of sight. The domestic market this year is about five plants. Last year it was upward of a dozen, and in the recent past, it has been up in the low 20's in each year. It should, in our opinion, be up at least in the teens if we are going to meet the power requirements of the 1980's.

We have built facilities for an annual throughput on the order of 10 to 12 plants per year, so we are betting very heavily that the market is going to come back. The present depressed state of the domestic market, as you know, is a result of two factors. One is the very small load growth, the growth of load demand in the United States over the last 2 or 3 years, coupled with the utilities financial situation where because of the flat growth, they have postponed generating projects as fast as they can to avoid the financing burden.

Mr. ZABLOCKI. Mr. Ottinger, do you have any questions?

Mr. OTTINGER. I would like to ask one question. First, I would like to make it clear I have a conflict of interest here. I have a brother-in-law that works for Westinghouse.

INTERNATIONAL CONTROL MECHANISM SOUGHT FOR TERRORISM

Both of you have stated control over the possible use of nuclear fuel or byproducts that could be used for weapons or seized by terrorists for weapons ought to be a matter of international agreement rather than a matter in which the United States place unilateral restrictions on the equipment that it sells. You express some confidence that can be done. A great many of us are concerned that this whole thing is getting out of hand, as you point out, and regardless of how we act, this is going on all over the world.

Can you give us any idea of what your conception would be of an effective international control mechanism, what provisions could be included in an international treaty that would give reasonable safeguards?

SEPARATION OF ISSUES SEEN AS POSSIBLE SOLUTION

Mr. BETHEL. Yes, I think first of all I would separate—and I have proposed this informally in a forum with the State Department, ERDA, and ACDA—the issue of nuclear power reactors from the issue of the control of nuclear fuel going into and the control of nuclear fuel coming out of those reactors, so that the business of licensing for export and building the reactors in the countries where the power is needed can proceed and that the real controls need to be on how the fuel is handled.

There I think it is quite simple. You must have controls which account for, in a very real way, a physical count and a continued physical count as the fuel moves from the time the fuel comes out of the power reactor, while it is being transported to the reprocessing center, and then as it goes through the reprocessing center where the plutonium is extracted and made, in a mixed oxide fuel plant, into mixed uranium and plutonium oxide.

It is in the tail end of the fuel cycle that there is the most concern over plutonium. If there is concern over uranium, then you have to go to the head end of the cycle, the enriching cycle, and exercise the same kind of accountability so that first of all, enrichment is not carried above the level that is needed for power reactors, since the material at the level of power reactors—I am speaking of uranium-235—is by no means a thing to be feared as far as proliferation. The uranium-235 level of enrichment is so low that it is not safe as a weapon. It is at the beginning and more so after the material comes out of the reactor.

The only concern—and one which is not a proliferation concern—is a concern over a terrorist attack which could, in effect, totally destroy the plant and release fission products and radioactive material. But, that is a physical security problem that I think can be dealt with a variety of ways.

REALITIES TO CONSIDER WHEN DISCUSSING TERRORISM

Mr. Walske. I think it is necessary in the safeguard business to sort out safeguards against terrorists or criminals from safeguards against nations that would proliferate a nuclear weapons capability. They are related, but there is a great difference.

In the first place, with regard to terrorists or criminals, all nations are against terrorists and criminals. Essentially they are. So, when you talk in terms of an arrangement or agreement, it is not difficult to get the French, Germans, or British to agree with the United States that certain ways are sensible for guarding nuclear materials as part of the fuel cycle.

The same way with sabotage against a nuclear plant. It is easy to get governments to agree to what should be done there. The kinds of things that need to be done are pretty well documented. Actually, guarding things is one of the oldest arts to man. It goes back to the caveman, and sometimes it is done well and sometimes poorly. If it is done poorly, you are in trouble.

We have determined in studies that at a reasonable cost you can guard nuclear materials in the whole fuel cycle very well. That can be done.

On the question of proliferation, it is very different. Physical situations that I have been talking about don't come into play. It is a question of diverting material by sovereign decisions, and it is not a question of overcoming guards and fences or a detector or things of that sort.

EMPHASIS SHOULD BE ON COUNTRIES INTENTIONS

So, in this case, what we really start with is not so much capability which is the emphasis, if you like, of some of the things we have been talking about. What we really must consider is intentions. I touched on this briefly in my prepared statement.

Countries have the intention to become a nuclear power or not become a nuclear power for a number of reasons. These include military, economic, and political reasons. The fact Sweden has not chosen to become a nuclear military power is due primarily to the fact that by not becoming one, it may keep some other country from feeling it is necessary to become a nuclear power.

Sweden has the technology. They don't need U.S. technology. They could build nuclear weapons very fast if they wanted to.

The same is true in many countries. In dealing with nonproliferation, the kind of progress under the Non-Proliferation Treaty and in disarmament negotiations are much more important than the factor of actual capability.

REACTORS VIEWED AS POOR MECHANISIMS FOR PROLIFERATING NUCLEAR WEAPONS CAPABILITY

I also mention in my paper very briefly that while we are focusing on power reactors as being a mechanism for proliferating a nuclear weapons capability, in fact, they are very poor mechanisms for proliferating nuclear weapons. They cost too much money. They are not quite the right technology, and to use nuclear power reactor fuel for nuclear weapons is about the most wasteful route possible. It results in a dependance on a foreign supplier, making you vulnerable to a cutoff in fuel supply if you are dependant on enriched uranium.

For all of these reasons, the question of the export of nuclear reactors and associated technology is actually a secondary question in proliferation, not a primary one.

Having said that, I still agree with efforts to control nuclear technology as it is exported, in a rational way, but I am trying to bring some realism into the discussion.

Mr. OTTINGER. Tell me, if I am wrong on that point, it would seem to me countries like India or Brazil have used the power reactor route to obtain nuclear materials for the development of weaponry and did so because the countries that have the fuel wouldn't sell them the fuel to make weapons, so India diverted the fuel it got for purposes of powering the reactor to weapons purposes.

ELABORATION ON INDIAN AND BRAZILIAN PROGRAMS

Mr. WALSKE. India is the only example, and India is the only example of diversion from a nuclear power program into a weapons purpose. They did so in that case. It was a rather special case. Their Canadian reactor is actually a better type for making weapons. They did it presumably for political reasons, and so on.

In the case of Brazil, everything I said I think holds in spades because the Brazilian program is immense, as it has been announced. in terms of capacity—far beyond any conceivable requirement they could have for generating plutonium for building weapons. They could build weapons in numbers to compete with the United States and the Soviet Union with the size power program they have. So, clearly, in logic the Brazilian program is primarily a power program, although I would confess that maybe in the back of the mind of some general in Brazil is the thought, "Well, yes, but maybe some day, having this technology and the ability to dip into it a little bit, would give me something that I conceivably shall want."

But, in logic, the Brazilian program, as constructed, is not the sensible way to get a nuclear weapons capability.

Mr. BETHEL. I would like to comment a little further on the Brazilian situation. I think we can show that what finally resulted there was not at all apparently what the Brazilians were after.

We are building the first nuclear powerplant for Brazil. The project has been underway for several years now, and we were negotiating with the Brazilian authorities for the next two units in their planned expansion of their nuclear generating capability.

BRAZIL'S NEED FOR ADDITIONAL UNITS

The basic reason that they were building the first unit and needed to go to another couple of units is that the massive hydroelectric projects that have been started are going to be a decade or more longer in completion than the Brazilians had contemplated. Thus, there is going to be a gap in their power generation to meet what they projected their needs to be.

In the negotiations for the next two plants, along with that, the Brazilian Government was carrying out discussions with our Government for the supply of the slightly enriched uranium material to fuel those reactors and to continue fueling of the one we were building.

There was never, in our—Westinghouse—discussions, a request for enriching technology. There was never, in our discussions, a request for reprocessing technology. It simply was not a point under discussion.

It was only after the U.S. authorities told the Brazilians that they could not convert the tentative commitments for slightly enriched uranium into fuel into firm commitments that the Brazilians dropped the negotiations with us and stopped talking to our authorities and went to Germany and came out with the package that they did come out with.

BRAZILIANS LOST CONFIDENCE IN COMMITMENT

The Brazilian were totally turned off to the United States, because they had lost confidence in what they thought was a commitment to supply them fuel and so with that, who could they trust, they then went after the bigger bundle, which would give them the wherewithall to eventually provide their own fuel.

Mr. OTTINGER. Under the international arrangements you contemplate, how would the controls work?

Mr. BETHEL. The controls would work in two ways. First of all, if there is ever a reprocessing plant built in Brazil, that would be under a strict daily inventory and accountability system to be sure that the uranium was not being enriched above the requisite percentage for fueling reactors. Also, when the reactor was shut down for refueling, the fuel elements as they came out of the reactor would go into the custody of the people responsible for operating a multinational regional processing plant and would be taken out of the custody of the Brazilians, except to be reprocessed and then sent back into the plant and kept in custody until the fuel was put back in the reactor itself.

Mr. OTTINGER. So, there would be IAEA inspectors on the site in Brazil?

Mr. BETHEL. There would have to be.

Mr. ZABLOCKI. One question of Mr. Walske. Could you amplify on your position regarding the regional enrichment reprocessing facilities. You say you have some difficulty with the practical application of this policy in the "real world." You then cite reasons for not having regional enrichment facilities.

PRACTICAL DIFFICULTIES REGARDING REPROCESSING FACILITIES

Mr. WALSKE. Not reasons for not having it. They are reasons why there are some practical difficulties.

Mr. ZABLOCKI. Yes, I understand; those factors include political considerations, the length of transportation routes which could increase exposure to criminal attack, and so on. But do you have any alternative to regional facilities which would be better suited to meet some of your concerns?

Mr. WALSKE. A national reprocessing plant will differ from a regional plant mainly in the fact that the regional plant will have some personnel from another country there so that with mixed personnel in the plant, you have a feeling that you will probably hear about a diversion, or you would hope you would hear about it more readily, if some material was being diverted from the plant. That is the advantage of the international plant.

Mr. ZABLOCKI. To what extent would the regional facilities be more acceptable because of the volume used in reprocessing?

ADVANTAGES OF REGIONAL FACILITIES

Mr. WALSKE. In some cases where the countries are small and only have a reactor or two, it wouldn't make sense for them to have a reprocessing plant. The one being built at Barnwell, S.C.—our largest one—that will accommodate, as I recollect, about 50, 1,000-megawatt reactors. There are a lot of countries that will have 1, 2, or 3, or maybe 10 such reactors.

In cases like that, the economy of scale would apply and would be very important.

Finishing up on the first point you raised, I think even though I am a little pessimistic about regional facilities, while still advocating them, at the same time we shouldn't take the view everything is lost if you have national reprocessing plants because still IAEA safeguards can be applied to the reprocessing plant and you still have a fair measure of knowledge of what is going on in the reprocessing plant.

In the end, if you have an international plant in any country, they can throw out the personnel and do with it what they want to. I go back to what I said in the beginning: The basic thing in proliferation is the intent of the countries involved.

If they are willing to pay the penalties in the world opinion and in terms of economic losses, nothing will stop them from getting a nuclear weapons capability.

Mr. ZABLOCKI. To what extent would you advocate IAEA be strengthened?

R. & D. OF ATOMIC ENERGY AND INTERNATIONAL COOPERATION SUGGESTED AS ADDITIONAL ROLE FOR IAEA

Mr. WALSKE. IAEA is doing a pretty good job, I think, as far as it goes. As far as strengthening, I think it is on the right track. It may be a little underfinanced and may need some pushing there.

The one personal idea that I would advocate is that perhaps IAEA should be split into an organization which deals with the questions of research and development of atomic energy and international cooperation in atomic energy, and then a safeguard organization.

My reason for saying it might be well to split the two functions is really to do with financing. IAEA is a hungry organization, generally, because it has been an R. & D. type technological, cooperative organization, and that is not probably the best way to attract the necessary funds in order to run a safeguards system. It is the wrong environment, slightly.

So, while the management and arrangements and international cooperation might remain the same, I think spinning off the safeguards function could allow for financing the support of those safeguards.

Mr. ZABLOCKI. Wouldn't that require a larger budget and administration cost for facilities, et cetera?

Mr. WALSKE. It should be larger, I think. The budgets of the safeguards functions. When you talk of strengthening the IAEA in the safeguards area, I think that is precisely where the strengthening is needed. It needs more money——

Mr. ZABLOCKI. You don't think there will be overlapping between the two?

Mr. WALSKE. Between the R. & D. areas?

Mr. ZABLOCKI. Yes.

AUDITING FUNCTION SEEN AS PRAGMATIC

Mr. WALSKE. Certainly there would be an interplay, but I believe one is sort of an auditing function, safeguards auditing function which is a very pragmatic important function, detailed type of function, and the other is a question of the interactions between governments and organizations in different countries and research and development and promotion of atomic energy.

Mr. ZABLOCKI. However, despite your concerns and despite the fact that we have no airtight formula for resolving them, doesn't necessarily mean we shouldn't attempt to do something in this area of proliferation.

Mr. WALSKE. I agree.

Mr. ZABLOCKI. Even though there may be a regional facility that may be lost if a country decides to expel the foreign nationals, this doesn't necessarily mean we shouldn't continue trying to cope with this problem as the nuclear energy proliferates.

Mr. WALSKE. I agree.

Mr. ZABLOCKI. I just didn't want to end on a very gloomy note. Sometimes you have to draw for an inside straight, you know.

Mr. WALSKE. Yes.

Mr. ZABLOCKI. Mr. Findley.

INEVITABILITY OF UNIVERSAL NUCLEAR POWERPLANTS

Mr. FINDLEY. I just have one final general question. I have the feeling that the proliferation of nuclear powerplants is a powerful force that isn't going to be deterred and the day will soon come when just about every country will view a nuclear powerplant as essential as the national flag.

Do you share my feeling?

Mr. BETHEL. I certainly do. As long as the country's minimum power needs are above a certain level that makes the first nuclear plants economic, the relief to that country's economy, that the economics of nuclear power bring, are such that they will just demand them to the extent that they can.

Mr. FINDLEY. What would you say, Dr. Walske?

Mr. WALSKE. I certainly agree, too. In many countries of the world they have gone extensively nuclear. All of France's new powerplants are nuclear. In Germany, the new orders are about 50–50, half nuclear and half coal.

Those are major programs. I don't have it with me, but I would like, with your permission, to submit for the record results of an international survey which we just completed on new powerplants being built and related data.[1]

I think it would be good data for your records, if you would like it.

ADDITIONAL DATA SUBMITTED FOR THE RECORD

Mr. ZABLOCKI. I note in your presentation you referred to other data and reports.

Mr. WALSKE. That has been given to your staff.

Mr. ZABLOCKI. We will include those in the record, as well as the material you will send in.[2]

There is one additional question. Mr. Bethel, you note on page 5 of of your statement that other nuclear plant suppliers impose less control and fewer restrictions of such sales than does the United States.

This point was not fully developed in the colloquy of why we lost sales to other countries. It was the financing you emphasized. But, the point I want to develop is this. In response to a similar question just last Thursday, a representative from ERDA, Mr. Nelson Sievering, first expressed the hope that the sale by Germany to Brazil had not taken place.

However, he then went on to note that the matter may not in fact be as black or as bad as it is at times understood to be. He said Germany placed the transaction under IAEA safeguards, thereby creating a trilateral agreement.

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[1] The international survey on new powerplants may be found on p. 390 of the appendix.
[2] Additional data and reports are found on pp. 402, 406, 413, and 447 of the appendix.

He further noted that Germany had achieved even additional restraints by preventing enrichment secondary or spinoff technologies from being duplicated outside safeguards. Since his interpretation of the sale of the nuclear reactor to Brazil and your interpretation of the sale seem to differ, would you care to comment?

DIFFERING OPINION ON BRAZILIAN TRANSACTION

Mr. BETHEL. Let me say that I have discussed this with Nelson and I think he is grasping at straws.

What he says there is true, that they have put them under IAEA. My contrast was between what the United States would require and what Germany would require. We would not have allowed the export of a U.S. reprocessing plant.

We wouldn't put it there in the first place. We would say under the present set of controls we don't think any controls are adequate for a single national reprocessing plant. That is what we are hung up on in Iran now, as I understand it, in achieving a bilateral. That is just this issue of reprocessing.

The basic point is we won't even go to the step, from the U.S. point of view, of permitting the thought of a single national reprocessing even under IAEA controls.

The other countries are. France is selling reprocessing plants, and Germany as well.

Mr. FINDLEY. I assume from that you assume this is an unrealistic position for our Government to take, and we should get in line with the rest?

UNITED STATES USING MISGUIDED PRETENTION AS THREAT OVER OTHER EXPORTING NATIONS

Mr. BETHEL. No, I do not agree we should get in line with the rest. The unrealism I think exists in the approach that we pretend we have a nuclear power monopoly when in fact we do not.

We are using this pretention as a club or a threat over the other exporting nations. I believe that a more fruitful approach is likely to be to convince the other exporter nations just as we as a nation—and I mean literally, industry and all branches of Government—are convinced that proliferation, the chance of proliferation is not an acceptable risk.

I think that every other exporter country can be persuaded of this. Then let's address the question, how do we take the edifice that has been created of the IAEA and the Non-Proliferation Treaty and how do we put into this, the additional strengths that are needed to put the whole international proliferation issue under the level of control that each of the participants thinks is appropriate?

I don't think it can be done by the United States alone. We must do it on an international basis.

Mr. FINDLEY. This has cost us business, as well as prestige, I assume?

UNITED STATES TERMED AS "INFLUENTIAL"

Mr. **Bethel.** It certainly is costing us business. Witness four reactors sold in Iran, two by Germany and two by France. No U.S. supplier is able to negotiate there because there is no bilateral. It cost us business—I tend to agree with Nelson's statement. I am not sure the Germany deal will live forever because the Germans are prettty tough businessmen.

We haven't given up. We think we may be able to sell them, but we are not in there now.

Another point I would like to make is that I think even if we don't achieve all the goals we are trying to achieve, I think we are in a far better position to influence the actions of countries who may not be signatories if we are present there with them participating in the business than if we are on the outside. I think that is a very important point that has not been made before.

Mr. **Walske.** I might add, if I had to choose between a German reprocessing plant or a U.S. reprocessing plant in Brazil, I would prefer the United States from the safeguards point of view. We are on the outside looking in right now.

Mr. **Zablocki.** We want to thank you gentlemen for the valuable time you have spent with us. We appreciate your answers to our questions and look forward to the additional materials you will provide for the record.

This hearing is adjourned until 10 o'clock tomorrow morning, Wednesday, November 5, in this same room. At that time our witnesses will be Hon. Fred C. Ikle, Director of the Arms Control and Disarmament Agency, and Mr. Myron Kratzer, Acting Assistant Secretary of State for Oceans, International Environmental and Scientific Affairs.

[Whereupon, at 11:25 a.m., the subcommittee adjourned, to reconvene at 10 a.m., Wednesday, November 5.]

NUCLEAR PROLIFERATION: FUTURE U.S. FOREIGN POLICY IMPLICATIONS

WEDNESDAY, NOVEMBER 5, 1975

House of Representatives,
Committee on International Relations,
Subcommittee on International
Security and Scientific Affairs,
Washington, D.C.

The subcommittee met at 10:15 a.m., in room 2255, Rayburn House Office Building, Hon. Clement J. Zablocki (chairman of the subcommittee) presiding.

Mr. Zablocki. The subcommittee will please come to order.

We convene this morning the sixth and last session of the subcommittee's hearings on Nuclear Proliferation: Future U.S. Foreign Policy Implications.

With us today to present the executive branch views on this subject from the perspective of their respective agencies are Mr. Myron Kratzer, Acting Assistant Secretary of State for Oceans and Environment and Scientific Affairs, and the Honorable Fred C. Ikle, Director of the Arms Control and Disarmament Agency.

Gentlemen, we are delighted you have come, and we look forward to your testimony on the specific problem of halting the spread of nuclear weapons.

We will hear first from Dr. Ikle.

STATEMENT OF HON. FRED C. IKLE, DIRECTOR, U.S. ARMS CONTROL AND DISARMAMENT AGENCY

Fred Charles Ikle, Director of the U.S. Arms Control and Disarmament Agency, is from California, where he was head of the social science department of the Rand Corp. from 1967–73.

Prior to assuming his present responsibilities, Dr. Ikle was known mainly for his contributions to strategies for reducing the risk of war. His work has covered analysis of ways to protect against accidental or unauthorized use of nuclear weapons, how nations negotiate, and the adequacy of the strategy of nuclear deterrence.

Ikle's work on the risks of accidental or unauthorized use of nuclear weapons contributed to improved safeguards by the military services, including the introduction of the "permissive action link," a device for making it physically impossible to arm a nuclear weapon without a release signal from a remote authorizing source.

Born in Switzerland, Dr. Ikle came to the United States in 1946. In 1948, he received his master's degree and, in 1950, his doctorate, both in sociology, from the University of Chicago.

He has been cochairman of the California Arms Control and Foreign Policy Seminar, and is a member of the International Institute of Strategic Studies, the

American Sociological Association, the Population Association of America, the American Political Science Association, and the Council on Foreign Relations.

Mr. IKLE. Mr. Chairman and members of the committee, I appreciate the opportunity to appear before you today. The occasion for these hearings is the House Concurrent Resolution 371. This resolution has its origins, of course, in your subcommittee, Mr. Chairman.

My colleagues in other agencies of the executive branch have already given you detailed comments on this resolution. I find myself essentially in agreement with them. I will, therefore, discuss the resolution only briefly and then add some general observations about nuclear proliferation.

Adoption of House Concurrent Resolution 371 would be a highly constructive step for Congress to take. We have only a few comments to offer. The first paragraph addresses the limits on strategic arms announced last year at Vladivostok and urges immediate follow-on negotiations for a mutual 20-percent reduction.

We support, of course, the objective of reducing the high levels of strategic offensive arms. A 20-percent reduction would be a significant step, but even larger reductions should not be precluded.

Permit me to point out that the negotiation of future reductions will be greatly facilitated by President Ford's accomplishment at Vladivostok of reaching agreement on equal numbers for United States and Soviet forces.

Without such a benchmark, the task of finding mutually acceptable reductions would be much harder. In the negotiations in Vienna, by contrast, on force reductions in Central Europe—the MBFR negotiations—we lack such an equal benchmark, and this fact has caused us added difficulties.

COMMENT ON PARAGRAPH 2

The second paragraph of House Concurrent Resolution 371 urges an adequate verified ban on all nuclear explosions if all nuclear weapon states will join.

The United States remains committed to achieving a comprehensive nuclear test ban treaty that has adequate verification provisions, but it has not determined that such an agreement would require the participation of all nuclear weapon states.

I would prefer that this issue be left open in the resolution.

In calling for an agreement banning all nuclear explosions, the resolution would prohibit peaceful explosions as well as weapons tests. This was the approach taken successfully in the Limited Test Ban Treaty of 1968.

So far, no solution has been found to the complex problem of how to have adequate assurance that weapons-related benefits would not be obtained from peaceful nuclear explosions permitted under a comprehensive test ban. Unless adequate verification measures can be developed, the ban on weapons tests would have to extend to peaceful nuclear explosions as well.

SUPPORT EXPRESSED FOR REMAINING PROVISIONS OF RESOLUTION

The third and fourth paragraphs of House Concurrent Resolution 371 address the danger that the transfer of peaceful nuclear technology might be diverted to weapons purposes and recommend several measures. I believe our current efforts are fully consistent with these measures, and we welcome such congressional support.

Mr. Chairman, my colleagues in the executive branch have briefed you, or will brief you, on our current efforts to slow the proliferation of nuclear weapons; in particular, our programs for export controls and international safeguards.

I do not wish to take your time to cover the same ground. Rather, I will give you my assessment of the long-term trends in nuclear proliferation.

It is the long-term prospect that one must keep in mind in order to judge the adequacy of our policies and to determine the need for further legislative or budgetary initiatives.

For the next few years, nuclear proliferation will not injure U.S. interests or cause us any direct harm. The threat of damage—the threat of disaster—lies in the future.

Today, as a result of the spread of civilian nuclear power, some 20 countries possess enough plutonium—if separated from spent fuel elements—to produce a few nuclear weapons.

Ten years from now the spread of nuclear reactors will likely see some 40 countries in possession of enough plutonium for a few nuclear weapons, while about 35 of these will have the material for a few dozen.

What could happen in such a world if the current restraints against weapons proliferation should be weakened? Let me raise two possibilities.

One possibility is that one or a few countries might abandon their self-restraint and produce nuclear explosive devices. If one such country produces a nuclear explosive, whether called peaceful or not, another may follow suit—and then others—for reasons of status or some military rationale or simply because of the growing attention to national nuclear explosive programs.

This could happen in violation of existing legal, economic, or political constraints.

"GRAY MARKET" AS ROUTE TO PROLIFERATION

A second route of proliferation could be a "gray market" for the means of making nuclear bombs, or for the bombs themselves. Unfortunately every new nuclear weapons state, or nuclear industrial state, is a potential exporter of nuclear explosives, or the materials needed to make them.

Materials, even weapons, could begin to be transferred between some countries without adequate restraint, so that a country even without a reactor program could come into possession of this means of mass destruction.

Of course, it is U.S. policy to prevent such developments. We have been successful in encouraging adherence to the Non-Proliferation Treaty and in tightening controls on the export of nuclear technology.

With our current policies—with the policies recommended in House Concurrent Resolution 371—we can postpone trouble. Given time and good luck, our other efforts toward a more stable peace might help reduce the tensions and conflicts that lead to competition in nuclear weaponry to begin with.

But since it does not lie within our power to prevent a further spread of nuclear weapons technology, much less to reverse the spread that has already occurred, we must have the means to cope with these new dangers.

IMPORTANCE OF ALLIANCES IN PREVENTING NUCLEAR PROLIFERATION

Mr. Chairman, we have to face these prospects squarely.

For the foreseeable future, our alliances are essential in preventing a massive spread of nuclear weapons. For many nations, protection through a strong alliance is now the only alternative to a desperate search for security by acquiring their own nuclear weapons.

Indeed, several nations with the greatest potential for nuclear arms now refrain from building weapons because of our alliance commitments. I believe Congress is well aware of this relationship between our alliance structure and nuclear proliferation.

But, there is something else needed to cope with the dangers of nuclear proliferation and to protect our country from nuclear damage in a world where the destructive potential of the atom has become widely available.

CONCERN FOR ADEQUATE INTELLIGENCE REQUIREMENTS

Mr. Chairman, this is the requirement for good intelligence, House Concurrent Resolution 371 does not mention this requirement. Mr. Chairman, I hope that this need will get the attention and support it deserves in the context of congressional activity on intelligence matters.

As of now, for example, we do not have good data on the size of plutonium stocks in some countries, the portion of plutonium that has been separated from spent fuel—and is therefore usable in weapons—or the location of plutonium stocks.

There is a widespread misunderstanding that the task of intelligence can now all be done by some technical instruments in celestial remoteness and antiseptic isolation from people, and in a manner for everyone to see and share meteoroligical data collected and fully disseminated on a world-wide basis. This, of course, is not the real situation, particularly not in the area of nuclear proliferation.

Peaceful nuclear technology provides the means as well as the cover for acquiring the nuclear bomb. Peaceful technology is sold and purchased through business channels, managed by thousands of people who work for many different industries.

The line between peaceful uses and the nuclear bomb is getting so thin and complex that we cannot expect to discriminate on the basis of remote physical observations alone.

What provides the critical discrimination is what people do and say. Intelligence about proliferation, therefore, cannot be divorced from intelligence about people, and by people.

DANGER OF DESTROYING INTELLIGENCE CAPABILITIES

However, instead of nurturing and improving intelligence capabilities that can do this job, we are now in danger of partially destroying them.

Mr. Chairman, prior testimony in these hearings has shown the fragility of the mutual restraints and international agreements that keep nuclear technology in check.

To maintain these restraints, we need good intelligence. If this structure should ever begin to crumble, one of our principal lifelines will be good intelligence.

Thank you, Mr. Chairman.

Mr. ZABLOCKI. Thank you, Dr. Ikle, for your thought provoking statement. It is an excellent statement. I would like to ask if you would develop further your last paragraph in your statement.

You said,

> Prior testimony in these hearings has shown the fragility of the mutual restraints and international agreements that keep nuclear technology in check. To maintain these restraints, we need good intelligence. If this structure should ever begin to crumble, one of our principal lifelines will be good intelligence.

I might say in passing, though, the resolution does not deal in any respect with the adequate intelligence or requirement for good intelligence. In our testimony we have raised the issue and I certainly would welcome your advice on the reference to the intelligence and how it should be referred to in the resolution.

TURBULENCE IN INTELLIGENCE INVESTIGATIONS MAY BE UNDERMINING

Before we would ask your advice on that point, would you please clarify or amplify your thought when you say, "We are now in danger of partially destroying them." I understand that to be partially destroying our sources of good intelligence.

Would you clarify for me what you mean?

Mr. IKLE. Mr. Chairman, what I was referring to here is something, which, as I believe, you know, I have mentioned before. This is a problem that during this difficult process of necessary congressional activity and executive activity on our intelligence organizations there is a great deal of turbulence.

In connection with this turbulence, there are more disclosures, or inadvertent statements—unintended statements probably largely—which can undermine the effectiveness of the means of intelligence. These means to be effective, whether for arms control in the strategic area or for proliferation, depends in part on their being unknown to potential adversaries, potential violators.

While we are in this period, which may be a transition period to new organizational and legislative arrangements, the protective legal backing and discipline against undesirable disclosure may not be adequate. That is why we all have to be particularly careful to maintain the capability.

POSSIBLE REVERSAL OF "INTELLIGENCE DESTRUCTION"

Mr. ZABLOCKI. Dr. Ikle, specifically, what must be done to reverse this trend of "partially destroying" them, using your term?

Mr. IKLE. What is essential here is a wide measure of agreement between the executive and the legislative branches; namely, adequate budgetary support for the operations and adequate legislative or legal backing, including legal provisions against unauthorized disclosure.

There are some existing laws on that subject in certain more narrow areas, such as atomic weapons design and communications intelligence, that have worked rather well.

There are other areas having to do with verification of arms control agreements and nonproliferation policies where such legislative protection does not exist or is not adequate.

Now, this is something which, of course, has to be worked out with due regard to the rights of privacy and to protection of our domestic processes from undesirable manipulation or interference by any organization.

Mr. ZABLOCKI. Have you any thoughts, Dr. Ikle, as to how the resolution could be strengthened by providing a requirement for good intelligence? Would you prefer to supply that for the record?

Mr. IKLE. I think it would better to supply this for the record. It occurs to me as a quick answer that one place might be the preambular statement mentioning the context of the problem. There may be other ways in which you might want to refer to it.

Mr. ZABLOCKI. We would welcome your suggestions.

Mr. IKLE. Certainly, Mr. Chairman.

[The information was subsequently supplied and follows:]

POSSIBLE LANGUAGE FOR REQUIREMENT FOR GOOD INTELLIGENCE

Insert for the preamble: "Whereas the effectiveness of such efforts must be supported by accurate data and information concerning the nuclear capabilities of all States, gathered through appropriate intelligence methods . . ."

Addition to the operative paragraphs: "(5) The Congress of the United States urges that effective intelligence methods be maintained in order to improve protection of the United States and its citizens from the risks of nuclear proliferation."

Mr. ZABLOCKI. On the basis of your statement on page 7, regarding the "widespread misunderstanding that the task of intelligence can now all be done by some technical instruments," et cetera, it was recommended that in our resolution on page 2, subparagraph 2, that "under adequate verification if all other nuclear weapons states will enter into such an agreement," be dropped from the resolution.

I gather you wouldn't agree with that suggestion?

VERIFIABLE NUCLEAR TEST BAN APPLAUDED

Mr. IKLE. In paragraph 2, we are talking about nuclear weapons tests. These are rather massive events. Great progress has been made in seismic technology to detect underground weapons tests.

Yet, there are still difficulties if they are very small tests. So, here the problem of verification can perhaps to a large extent be managed by technical means, remote technical means such as seismic observations. Hence, it is a perhaps easier task, but nonetheless, it is an important task and for that very reason we would want to have a verifiable nuclear test ban.

It is very much our position that a comprehensive test ban, much as a threshold test ban on limited test ban, must be verifiable.

Mr. ZABLOCKI. It would, therefore, in your opinion, be unwise to strike the phrase, "under adequate verification?"

Mr. IKLE. Yes, I think it would be unwise, Mr. Chairman.

Mr. Zablocki. The concurrent resolution on page 3 provides that

> The Congress, in order to reinforce international actions to prevent the proliferation of nuclear weapons * * * urges a halt on further transfers of nuclear fuel, technology and equipment to any country which has not accepted the International Atomic Energy Agency safeguards or which by January 1976 has not become a party to the NPT.

ALLOWING SUFFICIENT TIME FOR ADOPTION OF POLICY

This has been pointed out, that January 1976 would probably be insufficient time. Would you agree that amending the concurrent resolution to read "which by 1977 has not become a party," would be preferable?

Mr. Ikle. I think this would make it more meaningful. Of course, the important proviso there is the one at the end: if all other nuclear suppliers would make a halt of such nuclear transfers. For such a policy to be effective, it would have to be a policy adopted by all of the suppliers.

Mr. Zablocki. Putting a date 1977 would not delay or in any way harm our intent?

Mr. Ikle. On the contrary, Mr. Chairman, it would make the intent more meaningful by giving some time period here.

Mr. Zablocki. Thank you, Mr. Ikle.

Mr. Lagomarsino.

Mr. Lagomarsino. Dr. Ikle, when you submit your suggested language on verification by intelligence for the record, will you submit it to individual members of the committee as well?

Mr. Ikle. Certainly.

Mr. Lagomarsino. I take it that you are supporting the resolution pretty much as it is written? You do mention a few things. You say when we talk about an immediate follow-on negotiation for a mutual 20 percent reduction at those levels, levels of strategic nuclear delivery vehicles and number of strategic missile launchers, that even larger reduction should not be precluded.

Are you saying that we should change the language of the resolution?

INTENT IS ACQUIRING MAXIMUM POSSIBLE REDUCTIONS

Mr. Ikle. I think the intent of the resolution is clear. The objective is to get the maximum reductions that are compatible with realistic negotiating objectives, on the one hand, and a stable deterrent on which we have to rely for the foreseeable future, on the other.

Fixing very specific percentage figures does not seem to be the essential feature here. All I wanted to indicate is that we should not be locked into one particular target, say 20 percent, but that it is our intent in follow-on negotiations to get the maximum possible reductions consistent with realistic negotiating objectives and such that the stability of the deterrent forces would be not undermined.

Mr. Lagomarsino. In line with that thinking, do you think it might be wise to use some term other than stating a definite percentage; in other words, a "substantial ongoing" or something of that kind?

Mr. Ikle. I think this may well be a good choice, particularly as the record of the hearings will then indicate that the intent was to reach for a significant reduction, such as 20 percent.

INCREASED ACCURACY AND THROW-WEIGHT INCREASE MINUTEMEN VULNERABILITY

Mr. LAGOMARSINO. Along that same line, could you talk a little bit about what it might mean in terms of strategic stability for us to continue to reduce our strategic arms by say 20 percent if that is a figure we agree on while at the same time leaving uncontrolled imbalance in missile throw-weight, or accuracy?

Mr. IKLE. The combination of increasing accuracy and large throw-weight does increase the vulnerability of our fixed land-based missiles, the Minuteman force.

If there was an agreement on mutual balanced reductions, it seems likely that the reductions would occur in the most vulnerable forces first and thus, if the overall mix of the deterrent forces is properly balanced, the vulnerability should not increase as a result of reductions.

Mr. LAGOMARSINO. If it is balanced?

Mr. IKLE. Right. If the reductions can be taken in the most vulnerable forces, the percentage of forces at risk as a result of the increasing accuracy you mentioned or as a result of the large throw-weight, that percentage of forces at risk should become smaller. Hence, the portion of the deterrent forces that an attempted disarming attack could destroy would not increase, might even decrease. This would rather help.

Mr. LAGOMARSINO. Should the resolution speak to such things as throw-weight and accuracy?

Mr. IKLE. This perhaps goes beyond the kind of general advice I would want to give. This raises a question of the structure and the larger purposes of the resolution. I look at this resolution as being largely, if not primarily, concerned with proliferation and the Vladivostok ceilings, rather than the larger question of strategic arms limitations.

ADHERENCE CLAUSE NOT CONDUCIVE TOWARD COMPREHENSIVE TEST BAN

Mr. LAGOMARSINO. You also say with regard to the second paragraph of House Concurrent Resolution 371 that you would prefer that this issue, the issue of whether or not all nuclear weapons states would join in an agreement, be left open in the resolution.

Mr. IKLE. Yes. It is our position that such determination is not now necessary or indeed conducive to negotiations toward a comprehensive test ban.

Mr. LAGOMARSINO. So, you would end that section right after the word verification?

Mr. IKLE. That is right.

Mr. LAGOMARSINO. Which of course would not preclude us from requiring that in any agreement, in the first place?

Mr. IKLE. Of course not. We should not be precluded because in the future that may become a very important requirement, but we do not believe it is a necessary requirement at this time.

Mr. ZABLOCKI. Will the gentleman yield at this point?

Mr. LAGOMARSINO. Yes.

LANGUAGE FURTHER EXPLORED FOR SECTION 2

Mr. ZABLOCKI. In order to get support for the resolution nevertheless would it be your concern if on line 19, page 2 of the resolution, instead of "if" we say "under adequate verification, that preferably all other weapons states would enter into"? This wouldn't make this mandatory. We would have an expression that it would be preferable "if."

Mr. IKLE. I think some such wording would be quite consistent with our position. It might be preferable, "with the expectation that all nuclear weapons states would eventually enter into such an agreement," or some such wording.

It would be our objective that we have a comprehensive, verifiable test ban; namely, that it became a universal test ban.

Mr. LAGOMARSINO. I think there is merit to that. I would be concerned if we just eliminated the provision entirely. I think that would cause great consternation among our colleagues, at least some of them.

On the other hand, I can see a situation where perhaps we can agree with all the nuclear weapons states with, say, the exception of China and the agreement could be written in such a way that it would become inoperative or be suspended if China should test devices.

You know, there are a lot of possibilities here. We do not want to preclude ourselves from trying to reach some agreement.

UNIVERSAL BAN IS ANTICIPATED

Mr. IKLE. We are talking about the anticipation that if there is a verifiable comprehensive test ban we must have the anticipation that this will become the universal one. It may not be a prerequisite for getting started toward such an agreement.

Mr. LAGOMARSINO. You say on page 6, "indeed, several nations with the greatest potential for nuclear arms now refrain from building weapons because of our alliance commitments."

Would you care to comment on what nation you are talking about?

Mr. IKLE. We are thinking here of the major industrial nations allied with us, Japan, the Federal Republic of Germany, Italy, and other countries, countries with a large capability in the nuclear industrial field who are now or may be soon producing their own reactors, building their reprocessing plants, countries which clearly expressed the political intention of joining or have ratified the Non-Proliferation Treaty, thus committing themselves not to produce nuclear weapons.

Mr. LAGOMARSINO. You feel because of our alliances with them that they feel sufficiently protected without having that capacity themselves?

Mr. IKLE. Our alliance guarantee, and particularly our nuclear guarantee.

WITHDRAWAL OF OVERSEAS WEAPONS COULD HAVE ADVERSE CONSEQUENCES

Mr. LAGOMARSINO. One of the witnesses we had earlier suggested that we remove all of our nuclear weapons from overseas. I asked him about what we were just talking about, would that not merely encourage some nations that we might not want to have nuclear weapons to produce same.

He, as I recall, backed down.

Mr. IKLE. You are right, Mr. Lagomarsino, such an abrupt withdrawal of weapons that are considered an essential ingredient in the nuclear guarantee could have the most adverse consequences from the point of view of the willingness of the industrially capable countries to refrain from developing their own weapons.

Mr. LAGOMARSINO. I take it because of the fact that you have endorsed this resolution that you agree with the idea of regional facilities for processing and storing and fabrication and so on as mentioned in item 4 of the resolution?

Mr. IKLE. Certainly. As you recall, the idea of multinational nuclear fuel centers has been strongly supported and proposed by Secretary Kissinger in his United Nations speech.

We in the executive branch are doing further work on this idea. There are studies going on in the International Atomic Energy Agency on this subject.

Mr. LAGOMARSINO. Thank you.

Mr. ZABLOCKI. Mr. Bingham.

NUCLEAR TESTS: POSITION TAKEN BY FRANCE

Mr. BINGHAM. Thank you, Mr. Chairman.

Unless this has been covered, can you tell us in open session about the attitude of France at this point on nuclear tests, whether there has been any change in their position?

They have declined to enter into any agreement, as I understand it.

Mr. IKLE. It is still the position of France not to become party to the limited test ban of 1963.

Mr. BINGHAM. Am I wrong that they have indicated some intention of terminating their test service?

Mr. IKLE. I think what you are referring to here, Mr. Bingham, is the discontinuation of atmospheric tests, as distinct from underground tests. Complete discontinuation of tests in the atmosphere would, of course, in fact constitute acceptance of the limitation provided for in the 1963 treaty.

Mr. BINGHAM. They have so indicated.

Mr. IKLE. They have indicated their intention not to conduct atmospheric tests, at least at this time.

Mr. BINGHAM. Is it so qualified?

Mr. IKLE. I would have to check the official statement of the French Government on this point. We could provide this for the record.

[The information to be supplied follows:]

OFFICIAL STATEMENT OF FRENCH GOVERNMENT REGARDING NUCLEAR ATMOSPHERIC TESTS

The Government of France has made several statements concerning its future intentions with regard to nuclear testing in the atmosphere.

On June 8, 1974, shortly before the commencement of the 1974 series of French nuclear tests, the Office of the President of the French Republic issued a communique in which the following statement was included:

"The Decree reintroducing the security measures in the South Pacific nuclear test zone has been published in the Official Journal of 8 June 1974.

"The Office of the President of the Republic takes this opportunity of stating that in view of the stage reached in carrying out the French nuclear defense programme France will be in a position to pass on to the stage of underground explosions as soon as the series of tests planned for this summer is completed."

In a note presented to the Government of New Zealand on June 10, 1974, the French Government stated:

"France, at the point which has been reached in the execution of its programme of defense by nuclear means, will be in a position to move to the state of underground tests, as soon as the test series planned for this summer is completed.

"Thus the atmospheric tests which are soon to be carried out will, in the normal course of events, be the last of this type."

In a statement made to a press conference held by the President of the French Republic on July 25, 1974, the President said: ". . . on this question of nuclear tests, you know that the Prime Minister had publicly expressed himself in the National Assembly in his speech introducing the Government's programme. He had indicated that French nuclear testing would continue. I had myself made it clear that this round of atmospheric tests would be the last, and so the members of the Government were completely informed of our intentions in this respect . . ."

On August 16, 1974, in the course of an interview on French television, the French Minister of Defense said that the French Government had done its best to ensure that the 1974 nuclear tests would be the last atmospheric tests.

On September 25, 1974, the French Minister of Foreign Affairs, in addressing the United Nations General Assembly, said: "We have now reached a state in our nuclear technology that makes it possible for us to continue our programme by underground testing, and we have taken steps to do so as early as next year."

On October 11, 1974, the Minister of Defense held a press conference during which he stated twice, in almost identical terms, that there would not be any atmospheric tests in 1975 and that France was ready to proceed to underground tests. When the comment was made that he had not added "in the normal course of events," he agreed that he had not.

These statements, taken as a whole, were characterized by the International Court of Justice in its Judgment of December 20, 1974 of the *Nuclear Tests Cases (Australia* v. *France; New Zealand* v. *France)* as constituting ". . . a undertaking possessing legal effect," and found that "France has undertaken the obligation to hold no further nuclear tests in the atmosphere in the South Pacific" ([1974] *I.C.J. Reports*, pp. 269–270). In this case, however, the Government of France disputed the jurisdiction of the International Court of Justice.

INDIA'S INTENTIONS REGARDING UNDERGROUND TESTING

Mr. BINGHAM. Is there any statement by the Government of India as to their intention with regard to further underground testing?

Mr. IKLE. India, of course, is a party to the 1963 limited test ban, thus obligated not to conduct tests in the atmosphere. Apart from that, the Government of India, has not committed itself as to the question of tests for peaceful applications. It is the position of the Indian Government that their test of nuclear device was for peaceful purposes.

Mr. BINGHAM. As you point out here, that can't be distinguished.

Mr. ZABLOCKI. Will the gentleman yield?

Mr. BINGHAM. Of course.

Mr. ZABLOCKI. The witness the other day, Dr. Walske, stated an example of a country that has a nuclear reactor for peaceful purposes that had diverted this for military purposes was India.

His testimony was presented yesterday. Would you agree, Doctor? On what basis would he make such a determination, in your opinion?

THIN LINE DRAWN BETWEEN PEACEFUL AND MILITARY PURPOSES

Mr. IKLE. He may have used a short-hand term here in saying what all of us have been saying, that we do not now have a way of discriminating between tests of a nuclear device of a country that is just beginning a test program, discriminating whether it is for peaceful purposes or military purposes.

A country that is just beginning a program of testing nuclear explosives will inevitably learn something about nuclear explosives, and such an explosive is a very destructive device that could be used for military purposes.

The possibilities for discrimination, partial discrimination, may arise later on in a military program; whether there is an ability to manufacture delivery vehicles and a great many weapons, as distinct from a test program.

We have provisions in the transfer of nuclear technology for peaceful purposes that this technology or fuel shall not be used for explosive devices of any kind, whether intended to be peaceful or military.

Mr. BINGHAM. I think that is all. Thank you.

Mr. ZABLOCKI. Since I did mention Dr. Walske's testimony, he also raised a question of regional enrichment and reprocessing and fabrication.

He supported the policy basically. He did raise some very technical problems and points, such as the longer transportation routes, the political problems in certain areas and regions as well as the possibility because of the longer transportation for separating plutonium, increased exposure to criminal attack.

In pressing for his final decision as to whether he opted for this or against, he said he would support regional fabrication centers.

FACTORS TO CONSIDER IN SUCCESS OF REGIONAL CENTERS

Do you agree with him that having these regional fabrication facilities would increase the dangers that he has listed?

Mr. IKLE. The benefit of the multinational or regional centers from the point of view of proliferation all depends on how these centers are designed, how they would be operated, how the nationals of various states would work together in safeguarding the fuel, what the role would be of the International Atomic Energy Agency, what would be done about physical security against theft and sabotage, what the legal provisions would be to tie the whole structure together. There is also the question about the economic viability of the whole enterprise.

We have stated in further elaborations of this idea in the United Nations recently that the idea of multinational fuel centers should be regarded as just that, centers that may do a number of things, not necessarily reprocessing or not necessarily plutonium reprocessing at this time. There has to be a careful economic analysis as to what kind of activities in the fuel cycle should be taken up by such regional centers initially, and what kind of activity should be taken up later on.

EXIMBANK CONTENDS RESOLUTION IS "COUNTERPRODUCTIVE"

Mr. ZABLOCKI. In the testimony received in the past, particularly Mr. Minikes, I believe, of the Eximbank, he suggested—and I will quote him, if I may—I have his statement right here—"The proposed concurrent resolution would not be in the best interest of the United States."

His argument was, or course, that we need the export market for our industry and business and if we don't supply the nuclear reactors, other suppliers will be more willing to do so than we are, and with less safeguards. Therefore, he said the resolution was counterproductive.

Would you care to comment?

Mr. IKLE. I am not sure what aspect of the resolution he might have addressed. If he had in mind paragraph 3, you do have after all a clause at the very end, "if all the other major nuclear suppliers agree to a similar halt on such transfers." So, I don't see how paragraph 3 could raise this concern, nor do I see how the fourth paragraph can raise this concern about inhibiting in a discriminating fashion: our rights of exports as distinct from the exports of other countries.

Mr. BINGHAM. Will the gentleman yield?

Mr. ZABLOCKI. Yes.

Mr. BINGHAM. Do I understand that you state you have no objection to the condition in paragraph 3, but you would like to modify it in paragraph 2? Is that right?

Mr. IKLE. I have no objection at all to paragraph 3, that is right.

CLARIFICATION ON PREVIOUS STATEMENT

Mr. ZABLOCKI. This was pointed out to him that the resolution indeed does include if all other suppliers would agree. Apparently, he did not agree that that type of agreement would be foolproof. He basically made his presentation that the U.S. economy will benefit directly and indirectly from these exports and, therefore, we should not put in additional conditions and difficulties for U.S. suppliers to compete with foreign suppliers, since there is a financial advantage that foreign suppliers have, as well as other conditions.

May I go to another point? I am sure you are familiar with the GAO report on the private role in nuclear fuel as reported in last night's Washington Star. It states:

> The GAO report states that a $3.5 billion plant, which is backed by the Energy Research and Development Administration, ERDA, would give the Government too little control and leave it with too much risk in the business of manufacturing radioactive fuel cores for the nuclear powerplants of the future.

It was referring to the private enrichment project, which was composed of a consortium of interests called Uranium Enrichment Associates. Have you studied the report?

Mr. IKLE. I have not studied it, but I have seen the summary.

EFFECT OF PRIVATE ROLE IN NUCLEAR ENRICHMENT

Mr. BINGHAM. To what extent does the private role in the nuclear enrichment project affect our concern over proliferation of nuclear energy?

Mr. IKLE. The essential thing is that the United States be in a position to provide and guarantee supply of enriched uranium for the legimate power reactors. This is very important from the point of view of nonproliferation policies. If we can guarantee the supply of slightly enriched uranium for reactors we sell or for other reactors, we will reduce the incentive for various countries to try to provide their own enrichment services. Hence, it is an important instrument in our efforts to control the spread of nuclear technology that might be diverted to weapons purposes to have long-term capability, an increasing capability to meet the increasing demand for enriched uranium for the power reactors.

Whether that capability is provided for by a combination of private and Government facilities, by Government facilities, or by private facilities need not affect the objectives of the nonproliferation policy at all.

The important thing is that we get to moving fast. The proposal that the President made in June of this year is precisely to get going fast and to start planning and building these expensive, large installations that are now required to provide the services.

WOULD GOVERNMENT BETTER FINANCE ENRICHMENT BUSINESS?

Mr. Zablocki. According to this GAO report, it says that ERDA could set up a Government corporation to manage the enrichment businesses and that the corporation would be self-financing.

It implies that the Government could do the job better than private industry. Being aware of the attitude of some of the industries in this type of business and their desire for fewer controls, fewer safeguards, would probably be a better statement. I am concerned whether they would do a better job in the longrun than the Government.

Mr. Ikle. Mr. Chairman, from our point of view in the Arms Control Agency, our main concern in this area is nonproliferation; consequently, our intent is to insure that we are in a position to indicate that we can supply the enriched uranium.

I would not be concerned that private corporations doing this business would make it in any way more difficult to have the safeguards, protective measures, and legal constraints against diversion than would be the case if a Government agency did this. After all, in the past, private industry has worked not only in the peaceful nuclear field but in the nuclear weapons field. It has an excellent record of safety, of following Government regulations, and observing all our laws.

Mr. Zablocki. If we really and truly are concerned about nuclear proliferation, if we are going to provide as quickly as possible enriched fuel, are we going in two directions here?

GUARANTEED SUPPLY PROVIDES ECONOMIC INCENTIVE FOR TECHNOLOGY SPREAD

Mr. Ikle. This is mostly in the same direction. It is a fact that nuclear reactors for the production of electricity are now in operation in many countries and additional ones are being built.

Mr. Zablocki. When the reactors use up the fuel, it is the spent fuel and plutonium that is causing the problem?

Mr. Ikle. A great many of these reactors use enriched uranium, which by and large the United States supplies. The more that we can guarantee these supplies, the less interesting it will become for other countries to try to develop their own enrichment facilities.

Once a country has its own facility for enriching uranium, it can fabricate right there—in the technical sense at least, maybe not under the legal constraints accepted, but in a technical sense—it can fabricate material to build weapons. Hence, we would like to guarantee supply which would remove at least one economic incentive for the spread of enrichment technology, which is dangerous from the point of view of proliferation.

You are right, Mr. Chairman. When the reactors use up the fuel—that is, spent fuel—what could we do about reprocessing spent fuel? When you reprocess, you will have available plutonium, a problem I discussed in my opening statement and a problem that other witnesses have discussed.

Mr. BINGHAM. Will the chairman yield?

Mr. ZABLOCKI. Yes.

UNITED STATES WAS HANDICAPPED DURING GERMAN TRANSACTION

Mr. BINGHAM. That policy we have been following does not prevent Germany from making available to Brazil enrichment facilities and processing facilities, technology in that area.

Mr. IKLE. On the contrary, Mr. Bingham. The period during which Brazil made the decision to conclude its agreement with the Federal Republic of Germany was a period when we were handicapped in providing a clear guarantee on the supply of enriched uranium. If we are further handicapped in this way in the future, I would be concerned that this might lead to additional decisions of that kind.

Mr. BINGHAM. How were we handicapped?

Mr. IKLE. Because our existing capability for manufacturing enriched uranium was not sufficient to promise a guaranteed supply, under the conditions desired by a number of countries, for enriched uranium in the future, in the 1980's.

The demand is expanding, and our capability for enrichment is not. We have a gap between an expanding demand, resulting from the fact that more and more reactors are going into operation. And these are massive investments; governments want to plan way ahead. They do not want to sink $600 million into a reactor without having some guarantee that they can get the fuel to make this a worthwhile investment.

CAVEAT ON U.S. GUARANTEES

We—the U.S. government—because of the lack of expansion in our enrichment facility, are not in a position to provide the guarantees desired.

Mr. BINGHAM. Germany was not so constrained?

Mr. IKLE. This was a matter of concern for Brazil, not for West Germany, in this particular context.

Mr. BINGHAM. Except that I presume that we are unhappy about what West Germany did? Is that not correct?

Mr. IKLE. Let me make a point. The point I made was a more narrow point that for the United States to have a sufficient capacity for guaranteeing enriched uranium services will help dissuade other countries from trying to get their own enrichment facilities, something that is desirable, from the point of view of proliferation, to prevent.

In the case of Brazil, a possible factor in the situation may have been that the projected demand for enriched uranium outstripped our projected ability to supply.

Mr. Bingham. If the chairman will yield one more time, I still don't have from you any comment, I would like to get your comment, on the deal that Germany made with Brazil.

U.S. INABILITY TO PROVIDE LONG-TERM GUARANTEES

Mr. Ikle. This was a comment regarding the Brazilian considerations in entering into this deal which provided for West German assistance, or transfer, of technology for an enrichment facility. There may have been several motivations involved, but one Brazilian motivation may have been the U.S. inability to provide the long-term guarantees, which is related to the fact that our enrichment capability has not expanded, and relates to the President's proposal of June 26 for a program for adequate expansion.

Apart from that, it has been our policy, and it is our policy, not to export facilities for uranium enrichment or for the reprocessing of spent fuel, the plutonium. We would have much preferred if the Federal Republic of Germany had associated itself with this policy in its dealings with Brazil.

We had absolutely no objection to the export of the German power reactors. The point on which we had different views was the export of the reprocessing facility and the enrichment facility.

Mr. Bingham. Did we make representations to the West Germans?

Mr. Ikle. We certainly did, Mr. Bingham.

Mr. Bingham. They, nevertheless, continued to ship uranium to them?

DANGERS IN BREAKING OTHER LEGAL COMMITMENTS

Mr. Ikle. This raises a delicate question, whether as a result of a disagreement on policy with a country regarding legal restrictions to prevent proliferation it is a good idea to break other legal commitments you have with that country.

We have legal commitments to provide fuel to a number of countries. Of course, if these commitments are broken by the importing countries, then they become invalid. But, we cannot—it is not wise, to start breaking various other legal commitments in order to obtain leverage for some new legal commitments.

Mr. Bingham. Thank you, Mr. Chairman.

Mr. Zablocki. Dr. Ikle, could you advise the subcommittee what is the Uranium Enrichment Associates? What are they comprised of? What companies or corporations? Are you familiar with who they are?

PARTICIPANTS OF URANIUM ENRICHMENT ASSOCIATES

Mr. Ikle. I am vaguely familiar, Mr. Chairman. This is not really my province. Maybe some other witnesses might be able to give you further details on who the participating corporations are.

Mr. Zablocki. Perhaps some other witness or you, Dr. Ikle, could supply it for the record.

[The information follows:]

I am informed that subscribers to capital stock of Uranium Enrichment Associates are the Goodyear Tire and Rubber Company, the Williams Companies, and the Bechtel Corporation.

Mr. **Zablocki.** I still am concerned. I gather from your testimony today that you are likewise concerned with the nuclear proliferation throughout the world, but if we are going to give adequate enriched uranium and plutonium, we will continue to be suppliers of nuclear reactors, then you don't seem, at least I interpret it, to feel that the danger is so great, that we are not going to be contributing to nuclear proliferation, if we continue to be the supplier.

This confuses me. Maybe I am not really on it this morning.

Mr. **Ikle.** Let me try to comment on this question. It is important here to make some technical distinctions. The enriched uranium we are talking about supplying here is not suitable for nuclear weapons. It is slightly enriched uranium. But, it is an important fuel for a type of power reactor that we use widely and that we export.

Mr. **Zablocki.** It cannot be used even in the recycling process?

DISPOSAL OF SPENT FUEL IS PRIMARY CONCERN

Mr. **Ikle.** As it gets into the reactor, the form of the fuel cannot be used for weapons. To the extent that countries use this type of reactor, as distinct from other reactors which may use uranium so highly enriched it can be used for weapons purposes, or use plutonium exclusively, these types of reactors are very desirable from the point of view of nonproliferation.

You do have a problem of the so-called spent fuel, once the fuel has been used for the production of power, what do you do with it. For the time being, in this country, we put it in storage, which is relatively safe because these are large fuel elements, difficult to handle, not ready to be diverted to weapons purposes.

Further down the road there may be an economic justification in reprocessing that spent fuel, so as to get from it plutonium which can again be used to fuel power reactors. Now, once you have that plutonium, either in storage or in transit, you have a material that could be illegally diverted to make nuclear weapons.

That is the problem that we try to get a hold on with the safeguards and with special provisions for a number of cases where we try to have arrangements in such a way that the actual production of the plutonium will not take place in an area of special danger.

The regional centers tie in here, of course. It is the problem of making spent fuel and reprocessing fuel.

Mr. **Zablocki.** Before calling on Mr. Findley, we may find it necessary to go into executive session to obtain a reply to a question.

I will entertain a motion that we go into executive session if such becomes necessary.

Mr. **Findley.** I make such motion.

Mr. **Zablocki.** The roll will be called.

Mr. **Berdes.** Mr. Zablocki.

Mr. **Zablocki.** Aye.

Mr. **Berdes.** Mr. Fountain.

Mr. **Fountain.** (No response.)

Mr. **Berdes.** Mr. Bingham.

Mr. **Bingham.** Aye.

Mr. **Berdes.** Mr. Riegle.

Mr. **Riegle**. (No response.)

Mr. **Berdes**. Mr. Wilson.

Mr. **Wilson**. (No response.)

Mr. **Berdes**. Mr. Findley.

Mr. **Findley**. Aye.

Mr. **Berdes**. Mr. Lagomarsino.

Mr. **Lagomarsino**. Aye.

Mr. **Findley**. Mr. Ikle, if I recall Mr. Minikes' testimony several days ago correctly, he recommended that the United States go so far as to notify West Germany that if the Brazilian project goes through, that it will terminate its obligations to supply fuel to West Germany.

Would you comment on what effect this might have on the arms control responsibilities that you exercise?

FURTHER COMMENTS ON POSSIBLE TERMINATION OF FUEL SUPPLIES

Mr. **Ikle**. I have already made some remarks on this point in response to Mr. Bingham's question. The problem here is that we have legal commitments with many countries to supply fuel for their legitimate power reactors.

The countries have made large investments in their reactors and very much depends on a continued fuel supply. On the one hand, you might say breaking these legal commitments, stopping the supply of fuel, would give you a lot of leverage.

On the other hand, you then get into the business of breaking a legally valid agreement with a friendly country. I am really puzzled how we could then ask a friendly country to help us construct an international legal order where the legal restraints are an important element to prevent proliferation.

Now, if a country that imported our fuel, in connection with that fuel import violated the conditions of the agreement for delivery of fuel, then there would be a case for stopping the supply.

Mr. **Findley**. That would be narrowing it down to the illegal use of that particular fuel.

Mr. **Ikle**. Or the agreement as a whole.

Mr. **Findley**. Dr. Ikle, we face the possibility at least that some proliferation of nuclear weapons will occur in the near future because according to witnesses at least any determined nation that has even a small amount of money for that purpose can create some form of nuclear weapon on rather short notice.

SHOULD UNITED STATES PROVIDE ASSISTANCE TO NUCLEAR WEAPONS NATIONS?

With that in mind, should our Government offer technology or advice, assistance in other forms, to nuclear weapons nations to enable them to promote the safety and controlability of these new weapons forces?

One reason I ask the question is that I just the other day heard Dr. Brzezinski suggest that the day may well be at hand when we should offer to help the People's Republic of China, which is a nuclear weapons power, with our technology for safety control of such weapons.

I am not asking you to respond particularly on China, but just generally.

Mr. IKLE. This idea attracts the fascination of academic discussions. In cases where we have a really close agreement of cooperation with a country regarding nuclear weapons, the possibility exists to address questions of safety in this manner.

In a general sense, of course, we have made clear in many of our policy statements the importance of maintaining the safety of nuclear weapons against theft, sabotage or unauthorized actions.

Many of the basic ideas are in the public domain and are potentially available to other states for our mutual benefit.

Mr. FINDLEY. Is our Government presently cooperating with any nuclear weapon state except for Great Britain in regard to the safety and controlability of such weapons?

U.S. REGARDED AS COOPERATIVE

Mr. IKLE. I think we are cooperating with many—I don't want to repeat myself, but I think in a sense we take a cooperative attitude in general by being rather open about the basic elements regarding the maintenance of safety and security of nuclear weapons so that the ideas, the basic aspects of them, are generally available for any prudent government to take advantage of in case it should not have thought of it itself.

Mr. FINDLEY. Should the executive branch use the McMahon Act as a restraining influence on that cooperation?

Mr. IKLE. We do not see it as a problem in this area. Otherwise, we would have made proposals.

Mr. FINDLEY. Thank you, Mr. Chairman.

Mr. ZABLOCKI. Mr. Bingham.

Mr. BINGHAM. Yes, I would like to pursue another line of questioning. What active efforts are being made today to persuade other countries that have not done so to join the NPT?

ATTEMPTS TO PERSUADE COUNTRIES TO BECOME PARTY TO NPT

Mr. IKLE. We try to seize every opportunity to convey to other countries our hope, our desire that they should become party to the Non-Proliferation Treaty. Often we find that there might be a policy review going on in a country and it is possible for us to make our views known to that country.

We pointed out at the Non-Proliferation Treaty Review Conference last May the fact that parties to the treaty have a preferential right to assistance in peaceful nuclear technology. We have used assistance in kind given the International Atomic Energy Agency to discriminate in favor of the parties to the treaty.

Mr. BINGHAM. Does your agency have the primary responsibility in this regard?

Mr. IKLE. Generally, on the Non-Proliferation Treaty, we take the lead action on all the questions of nonproliferation. We have efficient and well-functioning coordination among the agencies, the State Department, ERDA, Defense Department and so on.

Mr. BINGHAM. I mean specifically in pressing other nations to join.

Mr. IKLE. In pressing other nations to join, we usually take the initiative in watching, looking out for the interests of the Non-Proliferation Treaty. Again, this would be our primary concern. Beyond that, we are deeply concerned with cooperation with other agencies in making our nonproliferation policy as effective as possible.

Mr. BINGHAM. House Concurrent Resolution 371 does not now contain a paragraph specifically stressing the desirability of stepping up our efforts to persuade other countries to join NPT.

Would such a paragraph in your judgment be desirable?

Mr. IKLE. It would certainly not be contrary to our present policy. The question is, are there specific instruments we have to induce key countries not now party to the Non-Proliferation Treaty to change their position.

I think if we knew of such instruments, we would have used them.

ADOPTING NO-FIRST-USE POLICY ADVISABLE?

Mr. BINGHAM. In that connection, would it be valuable if we, the United States, were to adopt a policy of guaranteeing no first use of nuclear weapons against nonnuclear states?

Mr. IKLE. Do you mean, Mr. Bingham, against nonnuclear states party to the treaty?

Mr. BINGHAM. No, to any nonnuclear states. In other words, the fact that the United States has not adopted such a policy, is that an obstacle to persuading other countries to join the NPT?

Mr. IKLE. In my judgment, this is not an obstacle at all. There is a reason which came up at the Non-Proliferation Treaty Review Conference, understandably, that countries which have joined the Non-Proliferation Treaty and given up their right to manufacture nuclear weapons would prefer to have a commitment, a formal commitment that is to say, of the nuclear weapons states not to use nuclear weapons against them.

EFFECTS OF CHANGES IN OUR FIRST USE POLICIES

That is very understandable. But if you look at the reality, there is no threat of that kind really that would bother non-nuclear-weapon states, particularly the holdout countries not party to the Non-Proliferation Treaty. On the contrary, some of the important, potentially most capable nuclear weapons states, the industrially capable countries, as I mentioned before, very much depend on our nuclear guarantee for their protection.

To some of those allies of ours, a change in our policy regarding first use could be disconcerting. It could have the opposite effect from the intended effect of strengthening our nonproliferation effort.

Mr. BINGHAM. Would not that argument apply only with respect to use against nuclear powers?

Mr. IKLE. What these allies of course are concerned about is potential attack from nuclear powers or alliances led by nuclear powers, that is correct.

Mr. BINGHAM. Supposing it were possible to get all the nuclear powers to agree to adopt a policy of no use of nuclear weapons against nonnuclear powers. Would that advance the cause of nonproliferation in persuading countries to join the NPT?

Mr. Ikle. It would depend, Mr. Bingham, on how it would affect the confidence of our allies in the nuclear guarantee on which they rely now. Frankly, I do not see how it would affect the decision of the important countries that have chosen not to become parties to the Non-Proliferation Treaty, non-nuclear-weapon states.

Their concern—if you examine specific cases it is quite obvious—is not a concern about nuclear attack by nuclear weapons countries. There are other reasons why they chose not to become party to the Non-Proliferation Treaty.

Mr. Bingham. Thank you, Mr. Chairman.

BRAZIL AND HER COMMITMENTS

Mr. Zablocki. Mr. Lagomarsino, do you have any further questions?

Mr. Lagomarsino. On page 3 of the resolution, at the top of the page, we talk about urging a halt on further transfer of nuclear fuel technology and equipment to any country which has not accepted the IAEA safeguards or has not become a party to the NPT treaty. What is the situation with regard to Brazil? Have they accepted IAEA safeguards?

Mr. Ikle. Brazil has accepted IAEA safeguards, particularly in connection with the agreement with Germany for technology and equipment transferred to it. But Brazil is not party to the Non-Proliferation Treaty, and hence not obligated to have IAEA safeguards on facilities or equipment that they could build themselves, unless it is connected with a transfer of technology?

Mr. Lagomarsino. They have accepted safeguards with regard to the technology transferred to them?

Mr. Ikle. Yes.

COMMITMENTS EGYPT AND ISRAEL ARE PREPARED TO MAKE

Mr. Lagomarsino. What is the situation with regard to Egypt and Israel?

Mr. Ikle. Egypt has taken the position that it would be willing to ratify the Non-Proliferation Treaty, which Egypt has signed, if Israel did likewise.

Mr. Lagomarsino. Have either or both of those countries accepted IAEA safeguards?

Mr. Ikle. In connection with our discussions with Egypt, it is clear that Egypt is willing to accept not only IAEA safeguards, but additional stringent measures to protect the interest of nonproliferation. Likewise, Israel is willing to accept IAEA safeguards on technology newly imported from the United States.

Mr. Lagomarsino. On newly imported?

Mr. Ikle. The position is a common one to a great many countries not party to the Non-Proliferation Treaty, in that they are willing to accept IAEA safeguards—a position that is common to Brazil, Argen-
not party to the Non-Proliferation Treaty, in that they are willing to
them.

But by and large, it is only the parties to the Non-Proliferation Treaty that have accepted the obligation to have IAEA safeguards on all facilities on their territory.

CURRENT TRANSACTIONS SEEN AS CONSISTENT WITH RESOLUTION

Mr. LAGOMARSINO. So, if this resolution were to pass and be implemented, it would not affect the transactions that are currently being discussed? I mean, it would affect them but apparently both countries would be willing to do what they would have to do to come within the framework of what we are talking about.

Mr. IKLE. Our current position regarding possible transactions is fully consistent with the resolution.

Mr. LAGOMARSINO. I have no further questions.

Mr. ZABLOCKI. If there are further questions, I am sure you would not object to having any questions from members of the committee or the staff submitted to you for answers for the record.

[The questions submitted and responses from Dr. Ikle follow:]

RESPONSES BY DR. IKLE TO QUESTIONS REGARDING NUCLEAR FREE ZONES SUBMITTED BY THE SUBCOMMITTEE

Question 1. What is the official policy of the United States to the issue of Nuclear Free Zones? What is that U.S. policy specifically in reference to NFZs vis-a-vis the NPT?

Answer. The U.S. Government has long considered that the establishment of nuclear-weapon-free zones in appropriate regions of the world could usefully complement the Non-Proliferation Treaty as a means of preventing the spread of nuclear weapons.

In assessing any particular NWFZ arrangement, the United States takes into account the extent to which it satisfies conditions we consider essential to a zone's effectiveness. In this connection, we have set out a number of basic criteria applicable to any nuclear-weapon-free zone:

The initiative for the creation of the zone should come from States in the region concerned;

All States whose participation is deemed important should participate in the zone;

The establishment of a zone should not disturb existing security arrangements to the detriment of regional and international security; and

The zonal arrangement should provide for adequate verification of compliance with the zone's provisions.

In addition, we have stated that:

The zonal arrangement should effectively prohibit its parties from developing any nuclear explosive device, for whatever purpose;

The zonal arrangement should not seek to impose restrictions on the exercise by other States of rights recognized under international law, particularly the principle of freedom of navigation on the high seas, in international airspace, and in straits used for international navigation and the right of innocent passage through territorial seas; and

The establishment of a zone should not affect the existing rights of its parties under international law to grant or deny transit privileges, including port calls and overflight, to other States.

Question 2. With the exception of the Treaty of Tlatelolco (Latin American NFZ) how much attention did the United States devote to the subject of NFZs prior to the early 1970's? Within which department or agency of the U.S. Government was this work carried out and what form did it take?

Answer. A number of proposals for nuclear-weapon-free zones in various parts of Europe were made in the late 1950's and early 1960's, although they were not considered realistic in the prevailing political and security situation. The U.S. Government did, however, express support during the U.N. General Assembly's 1965 session for African efforts to establish a nuclear-weapon-free zone on that continent. In addition, the United States participated actively in the negotiation of the Antarctic Treaty in the late 1950's and the Outer Space treaty in the mid-1960's, both of which, among other things, provide for the prohibition of nuclear weapons in their respective regions.

This effort involved the same Executive Branch agencies which continue to be interested in nuclear-weapon-free zone matters, principally the U.S. Arms Control and Disarmament Agency, the Departments of State and of Defense, and the National Security Council.

Question 3. Which department or agency within the Executive Branch currently has responsibility for NFZ matters?

Answer. Responsibility for nuclear-weapon-free zones questions continues to be shared among the agencies mentioned above.

Question 4. Has the issue of NFZs been the subject of any study or NSSM by the National Security Council?

Answer. While nuclear-weapon-free zones have been studied from time to time on an interagency basis, no NSSM has been issued. However, an interagency review of basic nuclear-weapon-free zone issues was initiated several months ago and is currently in progress.

Question 5. The following statement appeared in a report prepared this summer by the Ad Hoc Group of Qualified Governmental Experts for the Study of the Question of Nuclear Weapons Free Zones to the Conference of the Committee on Disarmament [CCD/467, 18 August 1975, p. 18] :

"China has supported the idea of creating a nuclear-weapon-free zone in Africa and has declared its readiness to assume commitments in regard to the zone. The Soviet Union has supported the efforts of African States to establish a nuclear-weapon-free zone in Africa . . . The United States has considered that it was premature at that early stage of development of the zone to enumerate the specific responsibilities that should be assumed by outside States and that such undertakings should be the subject of further consultations between the States of the region and the outside States."

Answer. What initiatives are the U.S. prepared to exercise relative to African NFZs?

It is a basic tenet of the U.S. position on nuclear-weapon-free zones that the initiative should come from States within the region. In the case of Africa, the heads of state and government of States members of the Organization of African Unity have stated, in a 1964 declaration, their readiness to undertake negotiations for the establishment of an African nuclear-weapon-free zone. These negotiations have not yet taken place. Within the framework of its stated criteria, the United States is prepared to enter into discussions with the African States when they decide to take further steps toward the establishment of a zone.

Quesion 6. What is the position of the United States to a recent proposal by New Zealand to establish an NFZ for part of the Pacific Ocean?

Answer. New Zealand, Fiji, and Papua New Guinea recently brought the proposal for a South Pacific nuclear-weapon-free zone before the U.N. General Assembly to seek that body's endorsement of the idea. The U.S. Representative stated at that time that the United States was not prepared to endorse the establishment of such a zone, in view of the intention expressed by its proponents of extending the zone to include areas of the high seas. The United States cannot endorse a proposal that contemplates restrictions on internationally recognized rights of navigation and overflight, including the rights of innocent passage through territorial seas.

Question 7. How does Diego Garcia affect prospects for some form of NFZ in the Indian Ocean region?

Answer. For several years States of the Indian Ocean region have been considering a proposal for the declaration of that Ocean as a "zone of peace." However, many major maritime States, including the United States, the United Kingdom, and the Soviet Union, have expressed their concerns over this proposal, which envisages the establishment by regional States of a special legal regime governing a part of the high seas. The United States has made clear that, in this region as in the South Pacific and other areas of the high seas, it is not prepared to support proposals envisaging the imposition of restrictions of internationally recognized rights of navigation and overflight. In the U.S. view, this is the central problem involved in the establishment of a nuclear-weapon-free zone or a zone of peace in the region, rather than the presence of naval facilities such as those on Diego Garcia.

RESPONSES BY DR. IKLE TO ADDITIONAL QUESTIONS SUBMITTED BY THE SUBCOMMITTEE

Question 1(a). How do you think our national security planning might be affected by the addition of large number of national nuclear forces of various sizes and capabilities?

Answer. Our present doctrine and weapon systems have been designed to deter only one or two clearly identifiable adversaries, and this deterrence is based on the premise that nuclear arms will always be under the control of leaders who care about the survival of their own country. In a world of many more nuclear countries, these premises would no longer be appropriate. Further, the possibility that large numbers of nations might develop their own nuclear forces is not the only threat, because non-nuclear nations and terrorist groups might also acquire nuclear weapons through a "gray market," as I have described in my prepared testimony. Moreover, in such a world it might even prove difficult to identify the persons responsible for a nuclear explosion. These conditions would gravely complicate the application of nuclear deterrence to threats against our nation and our allies.

It is hazardous to predict more precisely how our security planning might be affected and to anticipate at this time the changes in our forces and doctrine that would be required.

Question 1(b). Will our arms control opportunities vis-a-vis the Soviet Union be constrained by such developments? Will the requirement for dealing with such broad and disparate threats mean that we and the Soviets will be reluctant to reduce our mutual arsenals?

Answer. A further increase in the number of nuclear-weapon states and a further growth of their nuclear arsenals would introduce new risks into U.S. and Soviet defense planning. Such developments would complicate U.S.-Soviet arms control negotiations. At some point, reduction in the arsenals of the superpowers might appear more risky because of growing nuclear capabilities in third countries. However, it should be stressed that this is a rather distant problem.

Question 1(c). What sorts of threats to the U.S. might be posed by a minor nuclear power? What kind of response might we contemplate?

Answer. In the main, threats posed by minor nuclear powers would be threats to each other and to other minor non-nuclear powers.

It is likely that the nuclear forces of minor powers will not be "survivable systems," in the sense of mutual deterrence, because of the technical difficulties and high costs of survivable forces. Thus, these forces are likely to contribute instability to an armed conflict by presenting a tempting target for a nuclear disarming strike.

The United States might be faced with the direct threat of clandestinely delivered weapons. Another danger for the U.S. would be posed by events which could draw us into local nuclear hostilities. Even short of direct U.S. involvement, a local nuclear conflict between third powers could erode the present worldwide inhibition against the use of nuclear weapons.

Further research is required to anticipate appropriate responses to such threats.

Question 1(d). Once a country procures nuclear weapons, can we, or should we, try to offer ways to help assure the safety and controllability of the force?

Answer. If proliferation were to continue, newly emergent national nuclear forces may well be located in relatively unstable countries. The *internal* threat to the political order of such countries, posed by poorly controlled forces, is one of the more compelling reasons for them not to seek nuclear weapons.

There are, of course, technical means by which one can improve the safety and controllability of nuclear forces. But in a world of further proliferation—or even in a world with the present number of nuclear-weapon states—we should work to strengthen institutional defenses against the unauthorized use of nuclear weapons.

Mr. ZABLOCKI. At this point I want to call to your attention on page 4 of your statement, where you state:

> Today, as a result of the spread of civilian nuclear power, some 20 countries possess enough plutonium—if separated from spent fuel elements—to produce a few nuclear weapons.
>
> Ten years from now the spread of nuclear reactors will likely see some 40 countries in possession of enough plutonium for a few nuclear weapons, while about 35 of these will have the material for a few dozen.

IS PRESENT CONCERN ONE OF PROLIFERATION OR PROFIT?

I must reassert my concern that if we are going to go into wholesale supplying for the purpose of trying to provide enterprise a profit or for whatever reason without the proper safeguards to curtail proliferation and prevent the misuse of unspent fuel elements, eventually science will have a recycling process which will make it feasible, not only feasible but worth the cost.

I detect a departure from your prior position, and I may be wrong, but it appears to me that we are not so much concerned about nuclear proliferation if there is a little bit of a profit.

You perhaps would prefer to reply to that in a statement for the record.

Mr. IKLE. With your permission, I would like to give a quick reply now, and if you wish, I can provide a further statement later on.

It is precisely our current effort, our policy as to the conditions under which we export fuel or reactors, which provides the hope to stay on top of this trend. There is an ongoing trend of increased reliance on nuclear power, about which other witnesses in these hearings have testified. If we did not step in here and try to strengthen the cooperation of supplier countries, improve IAEA safeguards, and tighten the conditions under which we supply facilities or fuel to various countries, then indeed the problem would get beyond our control.

U.S. CURRENT POLICY REITERATED

These projections are important to keep in mind in order to realize the importance of what we are now doing and the importance of persevering in our approach to proliferation problems of the fuel cycle, and in particular, the use of plutonium, storage of plutonium, and reprocessing of plutonium.

Let me repeat again here our current policy. We do not export reprocessing plants. We seek to encourage regional reprocessing and, in special areas such as Egypt and Israel, we pursue agreements so that the reprocessing of our fuel will not take place in these areas. With all these steps, we try to keep on top of it.

Mr. ZABLOCKI. The greater number of nuclear reactors by a greater number of countries in my opinion multiplies the problem.

Mr. LAGOMARSINO. You are saying that, aren't you?

Mr. IKLE. It very much depends on the condition under which the reactors become available. A reactor by itself using slightly enriched uranium, where the spent fuel cannot be reprocessed in that country or the plutonium cannot be stored, does not represent a danger of diversion for weapons purposes.

On the other hand, if with other suppliers we did not try to use our influence, and did not use our leverage as a result of being able to provide legitimate reactors under proper safeguards, if we just withdrew from the process, then in time much less strict safeguard arrangements might develop.

It is important for the United States to develop here both conditions which we impose on exports, as we are now doing, and an influence which we can exercise in cooperation with the International Atomic Energy Agency and related activities with other supplier countries.

Mr. ZABLOCKI. Paragraph 5 of the Senate version refers to:

> The Congress of the United States urges a halt in the production of weapons grade material for weapons use under an adequate verification system. Following implementation of this provision, the Congress further urges, in order to

share American resources and to guarantee nuclear fuel as needed to satisfy the legitimate energy needs of participating countries.

We are considering including similar language in the House, at least the chairman has. When we have an opportunity to review your testimony and that of others and your further remarks on the last concern we will consider whether we will include that provision.

Thank you very much, Mr. Ikle.

Mr. IKLE. Thank you, Mr. Chairman.

Mr. ZABLOCKI. Mr. Myron B. Kratzer, Acting Assistant Secretary, Bureau of Oceans and International Environmental and Scientific Affairs, Department of State.

STATEMENT OF MYRON B. KRATZER, ACTING ASSISTANT SECRETARY, BUREAU OF OCEANS AND INTERNATIONAL ENVIRONMENTAL AND SCIENTIFIC AFFAIRS, DEPARTMENT OF STATE

Mr. Kratzer is Acting Assistant Secretary of State for Oceans and International Environmental and Scientific Affairs. After completing his studies, Mr. Kratzer worked as a chemical engineer in the petrochemical industry before entering the United States Atomic Energy Commission in 1951. After 1951, Mr. Kratzer occupied positions of increasing responsibility in the production, process development, civilian applications, and international affairs programs, reaching the position of Assistant General Manager for International Affairs in 1967. In August 1971, Mr. Kratzer joined the Department of State to occupy the combined position of Scientific Counselor and Representative of the United States Atomic Energy Commission. He served in this capacity at the American Embassy in Buenos Aires, Argentina (1971–1973) and the American Embassy in Tokyo, Japan (1973–1975). Mr. Kratzer returned to the Department in March 1975 to serve as Deputy Assistant Secretary in the Bureau of Oceans and International Environmental Affairs. He has been Acting Assistant Secretary of the Bureau since June 20, 1975. Mr. Kratzer received his B.S. in Chemical Engineering from Ohio State University in 1947. He holds several patents in the field of petrochemicals and has participated in numerous delegations to international conferences. In 1969 he was awarded the U.S. Atomic Energy Commission's Distinguished Service Medal. In 1961, he was recipient of the William A. Jump Award.

Mr. KRATZER. I know your time is very limited. I will try to keep my oral summary extremely short and to rely on the fact that many previous witnesses have covered this territory in considerable detail.

Mr. ZABLOCKI. If you will summarize your statement, your prepared statement will be part of the record.

Mr. KRATZER. I will try to go beyond that and not give a complete summary, but hit some of the high spots which I sense from the questions this morning are uppermost in your mind.

You questioned earlier in the hearing this morning, Mr. Chairman, whether or not the supply of reactors or continued participation in the nuclear market really serves the interests of the United States in halting the spread of nuclear weapons.

PARTICIPATION IN NUCLEAR MARKET: ARE U.S. INTERESTS SERVED?

I would like to comment briefly on that by pointing out that we began shortly after the war, in 1946, with a position that all nuclear activities should be undertaken on an international basis under international ownership and control: the so-called Baruch plan.

That plan for reasons we are all familiar with, was not adopted

We then entered into a period of secrecy and noncooperation. That was our policy until 1954. By 1954 it had become rather clear that the spread of nuclear technology, which by then was already more than 10 years old, was going to continue regardless of our efforts at secrecy.

Several countries had already developed their own nuclear weapons. Other countries were actively engaged in a rather substantial peaceful nuclear program. So, in 1954 we adopted with very wide executive branch and legislative support a policy of cooperation under effective controls.

I think this is essentially what Dr. Ikle was saying very effectively just before he left. This is a policy which we adopted not in the belief that our export of nuclear materials and equipment could be undertaken with acceptable risk, not merely that. We felt then, and we continue to feel that our active participation in this process which is going to go on in any case in fact reduces the proliferation risks.

MAINTAINING LEADERSHIP REDUCES PROLIFERATION RISK

As long as we can exercise leadership—and we have done that over the years—in gaining the widest possible support for the kinds of safeguards and controls which we believe necessary, I believe that the policy we follow reduces and does not enlarge the proliferation risks.

Now, that leadership has been exercised by us primarily because of what we had to offer, what our bargaining power was: The most advanced nuclear technology, the most efficient reactors and, perhaps above all, the supply of nuclear fuel—a material which, as Dr. Ikle pointed out is not a weapons material. Slightly enriched uranium is not capable of being transformed in its supplied state into nuclear explosive devices.

For that reason, I would like to strongly endorse what you have heard from other witnesses—the very great importance of our continuing to be in a position of being a reliable supplier of this material.

I am absolutely certain that the consequences of our withdrawing from supply or even being unable to adequately fill the needs which arise would be to stimulate the development of independent sources of supply elsewhere in the world.

That has already come about. It is accelerating the process of acquisition of reprocessing facilities and enrichment facilities which in a sense are a substitute for the supply of nuclear materials from a reliable outside source.

CONTROL BASED ON CONCEPT OF SAFEGUARDS

The effect we control to which I referred and which I believe give it the quality of slowing down, not contributing to proliferation, are basically built around the concept of safeguards.

When we supply material to other countries, we obtain their agreement to the application of a very unique set of controls, controls that are not simply bookkeeping, not simply accounting, but involve onsight inspections. These controls not only establish that the assurances which we receive that nuclear material will not be diverted are lived up to, but perhaps even more importantly they demonstrate on a visible worldwide basis that those assurances are being followed.

Such a demonstration breaks what could otherwise become a vicious circle of one country observing its neighbor engaged in a potentially dangerous nuclear energy program and seeking to emulate it by the acquisition of similar facility and similar materials on its own.

SYSTEM DETECTS VIOLATION AND DEMONSTRATES COMPLIANCE

In other words, it is the demonstration of compliance perhaps even more importantly than the detection of violation which is the important aspect of safeguards. Of course, the two go hand in hand: A system which can detect violations is a system which can demonstrate compliance. We believe it is an effective system. We pioneered the techniques that have been used in it. We have exercised leadership over the years in the International Atomic Energy Agency to insure that their capabilities are at a level which creates a real capability for the timely detection, and that is an important qualification, the timely detection of significant diversions of material. Along with that capability, we believe that those violations are in fact deterred.

Now, in recent years, especially in the last 2 or 3 years, there has been a great deal of attention given, and that is quite proper, to the issue of physical security.

There is some confusion as to how physical security relates to what I have just described as safeguards. The safeguard system which has been developed by ourselves and by the International Atomic Energy Agency, is designed to detect diversions and specially, although not uniquely, detect diversions that are actually perpetrated by the country itself, the country to which nuclear materials have been supplied.

TERRORISM AS ANOTHER FORM OF PROLIFERATION

But, there is another form of proliferation that we all are concerned about these days, and that is the actions not of governments but of subordinate groups or terrorists, perhaps even almost on an individual basis, to seize, to steal nuclear materials and using knowledge that has become available in the public domain to create either a nuclear explosive or at least a threat that they might have done so.

Now, every government has an interest in avoiding that risk. In other words, this is not an adversary situation between us and other governments. They have just as much interest in avoiding the illegal use, the unauthorized use and seizure of material in their possession as we do.

We are cooperating closely with all the governments with whom we have nuclear energy arrangements, and we are finding that they are quite prepared to institute good and effective physical security measures.

This is beyond the area of safeguards which, as I indicated, is covered by the international agency.

Now, just turning briefly to your resolution, it does hit what I think are the two crucial points in terms of nonproliferation policy. One of them is the question of, let us say, across-the-board application of controls to a country's entire nuclear activities.

No matter how effective we as a supplier may be, no matter how effective other suppliers may be, other opportunities are open to various countries. Just how great those opportunities are, how realistic they are, of course is a function of their state of industrial and technological knowledge; but opportunities do exist in a number of countries to undertake nuclear programs, not on the basis of supplied facilities and supplied material, but on the basis of their own efforts.

INTENT IS TO BRING ALL COUNTRIES UNDER REGIME

Paragraph 3 of your resolution goes to the heart of that issue. It is very much our policy—it was really the motivating force behind the Non-Proliferation Treaty which was promoted and advanced by the United States—to try to bring all countries under a regime, preferably the regime of the Non-Proliferation Treaty, that would involve the application of controls and safeguards to their entire nuclear activities.

Finally, your resolution touches very effectively on the issue of reprocessing. That is the crucial point in the fuel cycle where materials first become available in a form which makes them usable in nuclear weapons.

We are very much interested in establishing nuclear fuel centers on a regional and multinational basis. The Secretary himself has endorsed this idea in his recent address to the United Nations.

INTERNATIONAL AGREEMENT ON FUEL CENTERS URGED

It is an idea that we are not going to get overnight agreement to but it is very much not only our intention but part of our current efforts to explore this carefully and to urge international agreement on it.

In the meantime, I think we will have to deal with the desires and, in most cases, legitimate desires of many countries, to achieve some degree of independence in their fuel cycle activities.

How we bridge this gap between those desires and such efforts as multinational cycle centers is one of the many difficult problems in this field of nonproliferation.

I would like to end my summary at this point. It was a little longer than I intended.

[Mr. Kratzer's prepared statement follows:]

PREPARED STATEMENT OF MYRON B. KRATZER

Mr. Chairman and members of the committee, it is a privilege to appear before your committee today on behalf of the Department of State to offer testimony on the important subject of nuclear proliferation and, specifically, on House Concurrent Resolution 371.

At the outset, I should like to reaffirm the strong commitment of the Department of State to the policy of avoiding the proliferation of nuclear weapons. Secretary Kissinger has expressed personally, on a number of occasions, the importance of this goal and has proposed for international consideration several important measures designed to reduce the risks of further proliferation.

While House Concurrent Resolution 371 deals with several aspects of the control of nuclear weapons, I should like to concentrate my testimony today on the problem of nuclear proliferation as that term is generally used—that is, the acquisition by additional nations of a nuclear weapons or nuclear explosive capability. In particular, I will deal with the question of the proliferation risks arising out of the application of nuclear energy to peaceful purposes. Before commenting on the specific features of House Concurrent Resolution 371, I believe it may be useful to review the historical background of the proliferation issue, as well as some of the technical considerations which bear on it.

HISTORICAL BACKGROUND

Since the dawn of the nuclear age, U.S. policy has been to avoid the spread of nuclear weapons. The Baruch Plan, put forward by the U.S. at the United Nations in the days immediately after World War II, foreshadowed the efforts we have made for the past 30 years to lessen the likelihood of proliferation. This Plan proposed the prohibition of nuclear weapons and the placement of sensitive peaceful nuclear activities under international ownership and control. When the Plan was rejected by the Soviet Union, we moved to a policy of strict secrecy as a means of containing proliferation. In less than a decade, it became evident that this approach would not succeed. By 1953, both the Soviet Union and the United Kingdom had developed nuclear weapons. Major peaceful nuclear programs had been established by Canada and France, and were beginning in many other countries. These facts made it clear that, like all scientific knowledge nuclear science, which, indeed, had its origins in Europe, could not remain an American monopoly.

Later that year, President Eisenhower, in a speech before the United Nations, laid the foundation for the approach that has governed our non-proliferation policy ever since. In brief, he proposed world-wide cooperation in the peaceful uses of nuclear energy. This was to be accomplished under effective controls so as to insure that other countries could receive the peaceful benefits of the atom without establishing independent programs which could lead to the development of nuclear weapons. The Congress endorsed this approach in 1954 by fundamentally amending the Atomic Energy Act to permit our engaging in nuclear cooperation under strict procedural and substantive controls, including Congressional review and oversight.

The revised Act provided that certain forms of nuclear cooperation should take place under Agreements for Cooperation between the U.S. and each cooperating country or group of countries. Each agreement, including any amendments, must be personally approved by the President in writing on the basis of a determination that the agreement will promote, and not constitute an unreasonable risk to the common defense and security. Subsequently, each agreement is submitted to the Congress and referred to the Joint Committee on Atomic Energy which must report on it to the Congress. The Congress may prevent the agreement from coming into force by adopting a concurrent resolution to that effect within a thirty-day period thereafter.

NONPROLIFERATION MEASURES

I noted earlier that the approach we have followed since the early 1950's has been nuclear cooperation under "effective controls." These controls consist, basically, of assurances by other governments with whom we have agreements that materials and equipment provided by the U.S. will not be used for the production of nuclear weapons or for other military purposes, with these assurances being independently verified by measures, which we designate safeguards. Thus, this much misunderstood term refers to the mechanism which has been developed to assure and demonstrate the observance of governmental guarantees against the diversion of nuclear materials and equipment to military purposes. They rely upon independent and objective measures, including on-site inspection, applied by personnel from outside the inspected country, and designed to detect any diversion of nuclear material to unauthorized purposes.

This concept of independent verification of sovereign undertakings, through such measures as inspection by foreign personnel, was a novel one at the time, and the rights to make these inspections were achieved with considerable difficulty, through vigorous use of the bargaining power the United States could exert as a provider of nuclear assistance.

In the early days, and indeed up until the mid-1960's safeguards were applied by U.S. personnel. For the past decade the responsibility for the application of safeguards was assumed largely by the International Atomic Energy Agency located in Vienna. The need for such an international safeguards system was accentuated by the growing number of nuclear supplier countries. Today more than 50 IAEA inspectors are applying safeguards, including on-site inspection, to more than 60 major facilities in some 50 countries.

One of the common misconceptions concerning safeguards is that they involve only a system of materials accountability, or "bookkeeping". In fact, the safeguards system of the IAEA includes three basic elements: material accountability, containment, and surveillance. All three elements are necessary for an effective safeguard system, and each of them depends upon the actual physical presence of safeguards inspectors, supplemented in many instances by instruments, seals, and other technical measures. As an example, at nuclear power reactors, not only are discharged fuel rods accounted for through physical inventories by visiting inspectors, but seals may be installed on reactors (containment) to ensure that there has been no unauthorized fuel removal between inspection visits, and cameras may be employed (surveillance) to detect any unauthorized fuel movements in the spent fuel storage area.

It is important to recognize that international safeguards have a different and more difficult task to perform than do domestic control systems. The former cannot rely on the presumption that no massive conspiracy directed by the government itself exists. At the same time international systems can and do rely on the fact that a government itself has an overwhelming self-interest in ensuring that nuclear material in its possession is not diverted by unauthorized persons. The two systems therefore complement each other.

Safeguards, as I have attempted to make clear, are designed to verify the faithful observance by governments of their assurances against diversion of materials to unauthorized uses. However, the objective measures which they employ for this purpose are equally effective in detecting diversion arising from any source—national or sub-national. However, safeguards do not possess the capability of preventing theft, seizures or diversions of nuclear material by unauthorized groups or individuals in contrast to detecting such actions. This is the role of physical security systems, employing guard forces, physical barriers, and related measures applied by national authorities. The U.S. is engaged in an active and extensive program of consultation with nations which receive U.S. nuclear material to strengthen physical security measures. We have found that our partners are well aware that their own interests in preventing the theft or seizure of materials within their borders is at least as strong as our own, and they are cooperating fully in this endeavor. The International Atomic Energy Agency is also assisting in this effort by developing authoritative advice on the establishment of effective national physical security regimes.

How effective have our measures been against proliferation resulting from peaceful cooperation in nuclear energy? Today, more than 30 years after the commencement of large-scale production of fissionable materials by the United States, five additional countries have developed and tested nuclear devices. Only one country, India, has detonated a nuclear explosion making use of material produced under a program which was substantially assisted by outside sources under arrangements for cooperation in the peaceful uses of nuclear energy. In the Indian case, the plutonium utilized was produced in a research reactor and was separated in a reprocessing plant built by India. These facilities were supplied under peaceful uses assurances but these were not sufficiently clear to rule out the use of material for a nuclear explosion which was described as being for peaceful purposes. While there were provisions for inspection and reports, these did not have the effectiveness of current safeguards.

While the diversion of materials produced in the nuclear power fuel cycle is one possible route to proliferation, the facts I have cited indicate that the way employed so far has been the construction of simple facilities specifically designed for the production of fissionable materials. It was partly in recognition of this problem that the United States formulated, proposed, and actively supported the Non-Proliferation Treaty which requires non-nuclear weapon states which are parties to the Treaty not to acquire nuclear weapons from any sources, and to subject even their independent and indigenous nuclear programs to peaceful use undertakings, verified by safeguards.

We can conclude from the experience of the past that peaceful nuclear cooperation undertaken under sufficiently strong assurances and safeguards need not lead to proliferation. The one case where such cooperation, constructed to the development of a peaceful explosive device, as I have indicated, involved arrangements made at a very early stage of international nuclear cooperation and have not been duplicated in later arrangements. Nevertheless, we cannot afford to be complacent about a risk of the magnitude entailed by possible further proliferation. Accordingly, we and other leading nuclear nations have been engaged in a thorough and fundamental review of policies relating to international cooperation in the peaceful uses of nuclear energy.

Much of the concern in this respect has centered on the acquisition of facilities for reprocessing or enrichment of nuclear fuel, since it is these steps in the fuel cycle which allow the production of material of immediate usability in nuclear explosives.

Because there has been so much current discussion of the proliferation risks involved in the international transfer of facilities or technology for reprocessing and enrichment of nuclear fuel, I believe we should clearly understand the differences between them. Reprocessing technology has long been unclassified and there is much general information about it available.

Our ability, therefore, is not unlimited as to how effectively we can restrain the spread of reprocessing capabilities. On the other hand, the technology of uranium enrichment has remained for the most part classified and is not generally available. Furthermore, unlike reprocessing, the processes and equipment employed in uranium enrichment are far from conventional. Thus, there is no readily available basis for undertaking uranium enrichment in most countries.

There are also significant differences among various enrichment processes and reprocessing as to the readiness with which weapons usable material is obtainable. One of the purposes of reprocessing is to recover plutonium in usable form. An enrichment plant for producing light water power reactor fuel, however, need not produce highly enriched uranium. The conversion of enrichment plants designed to produce low-enriched uranium to the production of highly enriched material is not impossible but it is, for some processes, very difficult and probably quite detectable.

Much of our current effort in the field of nonproliferation is directed toward restraining the spread of reprocessing facilities under national control, while seeking concurrently to develop arrangements under which this step of the nuclear fuel cycle can take place with a minimum risk of proliferation. Toward this end, in his U.N. speech of September 22 of this year, Secretary Kissinger called for the establishment of multinational regional nuclear fuel cycle centers which would reduce the incentive for small and inefficient reprocessing facilities, limit the possibility of diverting peaceful nuclear materials to national military use, and create a better framework for applying effective international safeguards. The IAEA is currently studying this concept, including the economic and technical factors related to such regional centers. The establishment of such centers involves difficult technical, economic and political issues, which cannot be resolved quickly. Nevertheless, their potential advantages, not only to the achievement of non-proliferation but to the economic development of nuclear power clearly justifies the most determined posible effort.

Another important and constructive development in reducing the proliferation risks of reprocessing is the provisio in recent agreements the French and Germans have negotiated with their nuclear customers that applies safeguards to the transfer of nuclear technology. Under this approach, the recipients of sensitive nuclear technology are required to place under safeguards not only the facilities which they receive from a nuclear supplier, but any future facilities, including those built entirely on their own, which incorporate any of the sensitive technology originally supplied to them. This approach, thus, could bring under safeguards sensitive fuel cycle facilities which might otherwise come into existence without outside assistance.

The United States strongly favors this restraint on the export of any technology in sensitive areas, when such export takes place. At the same time, we believe additional restraint, which will avoid the spread of sensitive fuel cycle facilities under national control, is called for at the present time. It is for this reason that Secretary Kissinger, in his address to the U.N. General Assembly on September 22, proposed the establishment of multinational regional nuclear fuel cycle centers, a concept which, of course, is explicitly endorsed in H. Con. Res. 371.

Another area of importance is the evolution of international safeguards. The International Atomic Energy Agency has done an impressive job in establishing and implementing an effective safeguards system—the first of its kind in the world. As additional facilities and materials become subject to IAEA safeguards, and, especially, as the more complex and sensitive facilities such as reprocessing plants are brought under safeguards, vigorous efforts will be required on the part of the Agency and its members to ensure that effective safeguards are devised and applied. While the safeguarding of reprocessing plants and similar fuel cycle facilities is a technically difficult task, we believe there is no reason in principle why safeguards of a practical nature cannot provide a high degree of assurance that significant diversion will be detected.

While our policy of nuclear cooperation has as its primary goal the avoidance of nuclear proliferation, nuclear cooperation has other important goals. The economic and technical interdependence which results from the supply of U.S. reactors and nuclear fuel to other nations can strengthen political ties and can have an important stabilizing influence on internatioal relations. Additionally, the sale of nuclear equipment and services is of substantial economic benefit to the United States, with sales to date estimated at more than $2 billion and through 1990 estimated at over $40 billion.

HOUSE CONCURRENT RESOLUTION 371

Let me turn now to House Concurrent Resolution 371 introduced by you, Mr. Chairman (and the similar Senate Concurrent Resolution 69). First of all, I would like to reaffirm the commitment of the Department of State to the principles underlying both these resolutions. With specific reference to the House resolution, operative paragraph one urges that, after the provisos of the Vladivostok Accord of November, 1974 are embodied in a treaty, immediate negotiations take place looking towards a further verifiable 20 percent reduction in the number of strategic nuclear delivery vehicles and in the number of strategic missile launchers equipped with multiple independently—targetable re-entry vehicles.

The Department of State does not believe it desirable or prudent to specify in advance a particular degree of reduction since the size of the reduction would itself be one of the principal subjects of negotiation. The Department of State suggests the resolution be amended to urge a "substantial" reduction rather than specify a particular percentage to be achieved. (This same reservation applies to operative paragraph one of the Senate resolution.)

Operative paragraph two urges an adequately verifiable comprehensive agreement ending underground nuclear explosions, provided all nuclear weapons states enter into such an agreement. The relevant paragraph in the Senate resolution omits the adherence question. As you know, the United States is, committed to the goal of a Comprehensive Nuclear Test Ban Treaty providing adequate verification measures can be achieved. The Executive Branch, however, has not determined that the adherence of all nuclear weapons states is a prerequisite for the conclusion of such an agreement. The Department of State, therefore, would prefer that Resolution 371 note the U.S. commitment to an adequately verifiable Comprehensive Test Ban, but leave open the adherence issue in order to avoid prejudging our position.

Operative paragraph three of Resolution 371 urges a halt on further transfers of nuclear fuel, technology, and equipment to any country which has not accepted IAEA safeguards on all its nuclear programs or which by January 1976 has not become a party to the NPT if all other major nuclear suppliers agree to a similar halt on such transfers. (The language of the comparable paragraph in S69 is virtually identical.)

The Department of State fully subscribes to the objective of universal NPT adherence and/or acceptance of IAEA safeguards and will continue to strive for this objective. As the Resolution implicitly notes in the final clause of this paragraph, this objective is not currently shared by all consumers and suppliers. Hence, we welcome the Resolution's recognition that an essential element is agreement among all other major nuclear suppliers on this question. In the absence of such agreement, the U.S., by adopting such a policy unilaterally, would not only by relinquishing a major part of the international nuclear market to other suppliers, but also it would be seriously weakening its influence on the policies both of suppliers and recipient nations. Accordingly, we regard it as essential that we not unilaterally withdraw from nuclear supply to countries who are prepared, as the NPT requires of us to accept safeguards on our assistance. By so doing, I think we are better able to exert influence towards the achievement of our non-proliferation objectives in countries that are non-NPT parties.

Operative paragraph four of Resolution 371 urges an agreement providing that the reprocessing of plutonium resulting from any transfer between countries of nuclear fuel, technology, or equipment be performed in regional facilities which are heavily protected and guarded under the strictist possible multinational safeguards. (The comparable paragraph in S69, while differing in language is not substantially different.)

As I noted earlier in this statement, the establishment of such multinational centers is a U.S. objective, and we are working actively with the IAEA in studying their economic and technical feasibility. We must recognize, however, that there is no unanimity as yet on the desirability of multinational centers, and there may be formidable economic, technical and political problems which are as yet not well or widely understood. I believe that we should continue to work towards their establishment in a diligent way, but would not immediately go so far as to require their use on a mandatory basis for all plutonium reprocessing. We also need to take into account that without general acceptance of the multinational concept, such a requirement could drive nations to develop indigenous and unsafeguarded reprocessing plants, thereby defeating our objectives.

I would also note that paragraph four as written exempts from its provisions countries which could develop indigenous reactors utilizing indigenous fuel.

I hope these comments on the Resolution will be helpful to the Committee.

CONCLUSION

To return to the more general purpose of this hearing, I wish to emphasize my strong personal view that the proliferation of nuclear weapons is not inevitable. But to avoid such proliferation will require diligent pursuit of a variety of complex political and technical measures which minimize the pressures for proliferation and at the same time erect effective controls against it. We in the Department of State, along with our sister agencies in the Executive Branch, have been and will remain committed to such a course. I look forward to close and continuing cooperation with the Congress in this most important endeavor.

This concludes my prepared statement, Mr. Chairman. I will be pleased to respond to any questions the Committee may have.

Mr. ZABLOCKI. Thank you, Mr. Kratzer.

I commend you for summarizng your statement. You have touched on some very important points.

I have a general question first.

HAS THE UNITED STATES "GONE THE EASIEST ROUTE?"

You suggest in your prepared statement that an extensive spread of nuclear power is inevitable since secrets of nature cannot be kept. You then seem to imply that our policy for distributing this technology was the best available alternative. If we didn't do it under our safeguards, some others would do it, so we had to go this route.

Isn't it true, though, that a more thoughtful policy might have been conceived?

Did we have a massively subsidize otherwise uneconomic nuclear arrangement, for example?

Should we not have paid closer attention to economic need in individual contries?

Should we not also have taken into consideration other energy sources?

Certain areas in this world certainly would lend themselves very well to the exploration and experimentation and research in solar energy. Just because it is secret, it is open to all, does not mean that great resources are not required to develop it.

Did we make it a great deal easier than we had to as far as the area of nuclear reactors for energy?

Couldn't we have controlled the rate and character of nuclear spread, thereby giving ourselves more time to adjust and to plan effective security arrangements?

I realize it is a big question.

Have we gone the easiest route?

Mr. KRATZER. It is a very difficult and it is a very fair question.

I certainly would hesitate to say that in the course of action we have pursued since 1954 we have at every step of the way optimized all of our actions and all of our policies.

SUBSIDIZING: COOPERATION UNDER CONTROLS

What I endeavored to say was that the general approach which we have followed of cooperation under controls—as opposed to holding back—has been the correct one.

I think one can debate whether the form or the rate of our cooperation, at every step was always the one which, as I say, was optimum in terms of its control leverage, in terms of its slowing down capability. It would take a great deal of time to analyze various steps and see whether, in fact, they were.

I would want to make one comment, not in a contentious sense but just to allow the facts to be a little clearer.

The U.S. financial input—in other words, the question of whether we, in fact, subsidized unnecessary nuclear activities—has really been very limited.

We did make grants during the early days of this program, of $350,000 each to a number of countries to acquire very small research reactors which are not strategic in their nature which don't have significant nuclear material production capability.

Some equipment grants have been made, things of that nature. But, by and large, the basic input to the cooperative program has been the sharing of the assets which we have developed in our own program for our own use.

SHARING OF ASSETS IN TWO FORMS

Basically, these were of two kinds: The technology, the information which, as I have said, was rapidly entering the public domain with or without us, and, second, the access to our very efficient sources of nuclear material, but not on a gift basis.

These materials over the years have been supplied on a full cost recovery basis and I think without any doubt, although, again I don't put this forward in terms of contesting the issue that is posed by your question, without any doubt the net economic effect of our nuclear cooperation program has been from the point of view of the U.S. economy, a positive one.

In other words, it has earned revenues in the nature of foreign exchange of a substantial amount which would not otherwise have been earned, far in excess of any subsidies or direct Government costs involved in this cooperation.

But I want to hasten to add that the commercial aspects of this type of cooperation, in other words, the possibility for commercial gain, were never a substantial consideration in the policy that we have followed.

The policy was adopted and has been followed because we have felt that it contributed to our security and specifically to our nonproliferation objectives.

Mr. ZABLOCKI. I realize that my general question had several others. Without objection, I hope you would supply whatever additional comments you may have in response after you have had an opportunity to review.

[The additional comments of Mr. Kratzer follow:]

ADDITIONAL COMMENTS OF MYRON B. KRATZER

As I noted during my testimony before the Subcommittee, I believe the policies we have followed in the area of nuclear cooperation for the past 20 years have been generally correct. Whether in some specific instances there might have been a better alternative available is, of course, possible, but I do not believe this invalidates the general conclusion which I have just stated.

I think our record in this area, in terms of the implication nuclear cooperation has had on the proliferation of nuclear weapons, speaks for itself. In no case has our cooperation in the peaceful uses of nuclear energy led to diversion of nuclear equipment or supplies to military purposes. At the same time, I believe our policy of sharing this unique source of energy has had a beneficial economic effect in the countries with which we have agreements for cooperation which has promoted U.S. political and economic interests.

As to the concern that we have massively subsidized nuclear exports at the expense of other energy sources, such as solar energy, I do not believe the facts warrant this conclusion. The Export-Import Bank, the principal source of U.S. financing considers each application for assistance on its merits, regardless of whether the project is nuclear or non-nuclear. If, for example, a solar energy project met the economic criteria applied by the Bank, it would be treated exactly as nuclear energy projects are.

In summary, therefore, I think the policies we are following have had positive results in terms of economic benefits to both the U.S. and recipient countries and have contributed positively to our non-proliferation objectives.

Mr. ZABLOCKI. A followup question, of course, is that one cannot really say that any one project provides a net gain in economic and human welfare without taking external cost as a compensating factor explicitly into account.

One very major spillover or external cost of civilian nuclear power is the potential it provides for the production of nuclear weaponry.

REALIZATION THAT PLUTONIUM CONTRIBUTES TO COUNTRIES' NUCLEAR WEAPONS ABILITY

Do we take this into account in a serious way?

Mr. KRATZER. I don't think it is quantified, but we do take into account the extent to which any particular form of cooperation may contribute to that country's weapons potential or for that matter may entice or influence other countries to take similar actions.

I think I should say in response to this question, this is one of the unfortunate facts that we have to deal with, that nuclear power, because of the very unfortunate fact that the product of the operation of a nuclear power reactor is plutonium, does have the potential for proliferation, for contributing to a country's capability to build nuclear devices, if they choose to do so.

A GLANCE AT THE SIX NUCLEAR WEAPONS STATES

If we look at the history of the six countries, including ourselves, who have exploded nuclear devices, none of them has, to our knowledge, utilized material coming out of the nuclear power reactor cycle as a way of getting into the nuclear weapons field. All of them have built facilities that had a production potential, in other words, a capability to produce a weapons grade material—plutonium in most all of the cases, but in one case the first material produced was enriched uranium.

They have built facilities specifically designed for production. They have not depended on the power reactor fuel cycle as a source for weapons material. That does not mean to say that the power reactor cycle does not present that risk. As I said, it does and we have to contain that.

By containing that, I think the important thing we have to bear in mind is that it does not preclude recourse to this approach which, historically, has been the way that each of the six nations to date have entered into the production of nuclear explosive devices.

Mr. Zablocki. Thank you.

I have one other question which seems necessary to follow up.

QUESTIONS POSED REGARDING IAEA

Mr. Kratzer, you stated that we must depend on observation in order to get compliance intelligence. We have led the way in assisting IAEA but it does pose a question and we must therefore depend on the findings, the capability, the timely detection of violations by IAEA.

What degree of confidence can we place in IAEA findings?

Do we have access to inspectors' reports, for example?

Are we made aware of any regularized way of potentially significant discrepancies?

Do we learn of these things through back channel communications or directly?

What is the time delay between visits by inspectors?

Mr. Kratzer. Again, there are several questions in there.

Mr. Zablocki. If you wish, you may supply them for the record. I have a few related questions.

Mr. Kratzer. That is entirely up to you, Mr. Chairman.

I can respond to them.

Mr. Zablocki. Can you respond briefly and then amplify?

Mr. Kratzer. I will try to do that.

Let me say briefly we have confidence in the IAEA system. We think it has the capability for detection of significant diversions, which will at the same time deter them.

AGENCY ONLY REPORTS VIOLATIONS

We do not have routine access to inspectors' reports. These are regarded, and I think for good reason, as confidential by the Agency, but the Agency is required to report any violations or any suspicions of violations to its Board of Governors, of which we are a member. So, we have a negative reporting system, if you wish to look at it that way.

We know if problems occur, but we don't know when routine inspections have led to affirmative results. This is an area of some concern and I think we do hope to be able to make arrangements, not just for our own benefit but for the benefit of the Agency as a whole, which will provide member states greater access to appropriate information.

There is a need for confidentiality in this area, but perhaps we can improve that situation in some respect.

You asked about frequency of inspections.

This depends entirely on the nature of the facility, the amount of material and the kind of material which is handled. The Agency has a very detailed system—we were the leaders in its development—which identifies the kinds and the frequency of inspections that have to be carried out. In the most sensitive cases such as reprocessing plants, those inspections may be continuous. In other words, inspectors may be present full time.

Mr. ZABLOCKI. I have other questions. I will supply them to you.

Mr. Lagomarsino.

Mr. LAGOMARSINO. Starting on page 13 of your statement, you discuss the resolution, the House resolution, itself.

RESPONSES TO BE SUPPLIED FOR RECORD

On page 14, you state,

> The Department of State does not believe it desirable or prudent to specify in advance a particular degree of reductions since the size reduction would, itself, be one of the principal subjects for negotiation.

Then you go on to say you would prefer "substantial" be used instead of the 20 percent that is in the resolution.

Would you care to comment on that?

Mr. KRATZER. Mr. Lagomarsino, I would prefer to supply a response for the record, if you don't mind.

[The information follows:]

> As noted in our Report on H. Con. Res. 371, the Department of State would prefer that line 13 of operative paragraph one of the Resolution be amended to urge negotiations on a "substantial" reduction in the number of strategic nuclear delivery vehicles and the number of strategic missile launchers equipped with multiple independently targetable reentry vehicles rather than the 20 percentum reduction specified in the current version of the Resolution. We do not believe it desirable or prudent to specify in advance a particular degree of reduction since the size of the reduction would itself be one of the principal subjects of negotiation.

Mr. KRATZER. I did want to be comprehensive in my written statement but my area of responsibility is pretty much limited to paragraphs 3 and 4 of your resolution.

Mr. LAGOMARSINO. Would you do the same thing then, in regard to paragraph 2?

You were here during Dr. Ikle's testimony.

Mr. KRATZER. Yes. I will be glad to.

[The comment follows:]

> As outlined in our Report on H. Con. Res. 371, the U.S. is committed to the goal of a Comprehensive Test Ban Treaty providing adequate verification measures can be achieved. We have not yet, however, determined that the adherence of all nuclear weapons states is a prerequisite for the conclusion of such an agreement. We would prefer, therefore, that H. Con. Res. 371 note the U.S. commitment to an adequately verifiable Comprehensive Test Ban, but leave open the adherence issue.

Mr. **Lagomarsino.** Would you agree with him that perhaps inserting the word "preferably" as suggested by the chairman might satisfy both worlds here?

Mr. **Kratzer.** I will respond to that.

[The information follows:]

The Department of State believes the insertion of the word "preferably" on line 19 of operative paragraph two of H. Con. Res. 371 immediately after the word "verification" would be an improvement over the present version in that the resulting wording would conform more closely to the Department of State position that the question of adherence to an adequately verifiable Comprehensive Test Ban be left open at this juncture.

Mr. **Zablocki.** If the gentleman will yield, we have requested a report from the executive branch, which is still forthcoming.

Can you give us some assurance as to how soon we can get it?

Mr. **Kratzer.** We are very anxious to get it to you quickly.

EXECUTIVE BRANCH REPORT IS DELINQUENT

Your resolution does, as I just indicated in my response to Mr. Lagomarsino, include material that involves several different bureaus of the State Department, as well as different Government agencies.

Mr. **Zablocki.** How far down have they initially ruled?

Mr. **Kratzer.** I can't tell you that. You are quite right in asking.

Mr. **Zablocki.** It is moving?

Mr. **Kratzer.** Yes, sir.

Mr. **Zablocki.** Obviously, slowly.

Mr. **Kratzer.** I can only say that we will accelerate it.

[Consequently the executive branch response was transmitted to the Chairman of the House Committee on International Relations on November 26, 1975.]

Mr. **Lagomarsino.** In regard to paragraph 3, I assume that you would not object to changing 1976 to 1977?

Mr. **Kratzer.** No.

I think that would improve the realism of the resolution and therefore in reality increase its influence.

Mr. **Lagomarsino.** Otherwise, you are just freezing in the present situation.

Mr. **Kratzer.** Yes, sir.

Mr. **Lagomarsino.** Then, with regard to paragraph 4, I take it that you support paragraph 4 but you have some questions about it.

Is that an accurate way of stating it?

Mr. **Kratzer.** It coincides very, very closely with what we, in fact, are attempting, with what the Secretary, himself, has urged.

I certainly do not find it objectionable.

I only wanted to introduce a note of realism.

This is a difficult thing. I don't know whether it is achievable. That was my only purpose.

Mr. **Lagomarsino.** I have some question whether it would be achievable or not but certainly it is worth looking into.

I have no further questions.

COMMITTEE MOVES INTO EXECUTIVE SESSION

Mr. Zablocki. It is my understanding that the House is going to have a joint session in a few moments. It is mandatory that we be there. We had a notice from the Speaker regarding that yesterday. I understand there may be today a very pertinent announcement on the hearings we are holding.

If you have no objection, and with the permission of the committee, I will supply the questions that we have of you, Mr. Kratzer, for you to respond to for the record.

Thank you very much.

I want to apologize for hurrying you so because your testimony and your prepared statement are excellent statements.

We know that the replies you will supply for the record will also assist us in finalizing the House version in this particular area.

Mr. Kratzer. Thank you.

Mr. Zablocki. It is my understanding from the staff, Mr. Kratzer, that you would be more willing to comment on particular information that we would want if we could just go into executive session for 2 minutes.

Mr. Kratzer. Fine. I am at your disposal, Mr. Chairman.

Mr. Zablocki. The subcommittee will go into executive session.

Thank you very much for coming.

[Whereupon, at 12:05 p.m., the subcommittee adjourned, to go into executive session.]

[Subsequent to the hearings the subcommittee submitted questions to Mr. Kratzer. Those questions and responses follow:]

Responses By Mr. Kratzer to Questions Submitted by the Subcommittee

Question 1. What kind of sanctions would you recommend for any Middle Eastern country that, as a result of our supplying nuclear technology, began to acquire nuclear weaponry?

Answer. The introduction of nuclear weapons into the Middle East would be a most serious development, and we would not want to see any Midddle Eastern state acquire possession or control over such weapons. Such a development could not help affecting our bilateral relations, although precisely what we should do would depend on a number of considerations which cannot in the nature of things be predicted in advance.

Question 2. Can you tell us, as precisely as possible, what criteria the State Department uses in determining whether we should enter into an agreement of cooperation with another nation.

Can you provide for us a detailed picture of the kind of information and analysis that the State Department gives NRC regarding the political rationale for a particular nuclear transfer.

Answer. As a general proposition, the Department of State operates from the premise that the benefits of the peaceful uses of nuclear energy should not be withheld from other friendly nations, and that the risks of nuclear proliferation would be minimized rather than increased if nuclear assistance under effective controls is made available as an alternative to unrestrained national development. Under this principle, we are, therefore, willing and anxious to continue contributing to the development of peaceful applications of nuclear energy in cooperation with our partners throughout the world through the supply of materials, equipment, and appropriate technology under prudent safeguards and other measures which are necessary to ensure that this assistance does not promote military applications, including the development of nuclear explosives of any kind.

In applying the above conceptual framework, the Department of State, in close coordination with other appropriate government agencies, also takes into consideration other relevant factors in determining the merits of a particular agreement for cooperation. These include the other nation's position with respect to nonproliferation, the adequacy of safeguards and physical security measures that would be established in the recipient nation, the economic need for nuclear energy in the other nation, national security implications, if any, attendant to the nuclear transfers that would take place under an agreement for cooperation, and, of course, whether such an agreement would be in U.S. foreign policy interests.

When providing the Nuclear Regulatory Commission information and analyses on a particular nuclear transactions, the Department of State, on behalf of the Executive Branch, addresses the following questions:

1. What is the purpose for the export?
2. Does the recipient country have an Agreement for Cooperation with the United States under Section 123 of the Atomic Energy Act, as amended? And, if so, is the export in question covered by the Agreement?
3. Has the recipient country accepted and implemented IAEA safeguards and/or other appropriate supplementary bilateral conditions (including where applicable, understandings regarding reexport) imposed by the United States?
4. In cases in which the recipient country is not required by the NPT to accept IAEA safeguards, does the recipient country or organization have accounting and inspection procedures such as to assure compliance with the requirements of the relevant U.S. Agreement?
5. Does the recipient country have adequate physical security arrangements to deal with threats of subnational diversion of significant quantities of nuclear weapon materials (plutonium or highly enriched uranium)?
6. What is the position of the recipient country with regard to nonproliferation (e.g., party to NPT, LANFZ, public statements)?
7. What understandings does the United States have with the recipient country with respect to the use of U.S.-supplied material or equipment to acquire or develop nuclear explosive devices for any purpose, and as to the recipient country's policies and actions as to such development using equipment and material from any such source?
8. What other factors are there which bear on the issuance of the export license, such as further U.S. understandings with the recipient country, other supplier countries or interested regional countries?

In sensitive cases, we supplement the above date by providing the NRC with additional information on the political factors that bear on a given transaction.

Question 3. With regard to the reactor sale to Egypt and Israel, have detailed and competent analyses been undertaken in order to determine if this is the most efficient means of power generation for these countries?

(*a*) Given the scarcity of resources and the magnitude of human needs, does the acquisition of a nuclear power capability seem to you the most compelling need for both of those countries?

(b) Is there an existing or projected power deficit in either of these countries?

Answer. In the case of Egypt, there have been three separate analyses of its present and projected energy needs. These were conducted by the Egyptian Government, the International Atomic Energy Agency, and the World Bank. All three of these studies forecasted energy shortages in Egypt in the 1980's.

Egypt has virtually no coal resources and the Aswan Dam, now operating at optimum capacity, leaves little unexploited hydroelectric capacity. Even with the return of the Sinai oilfields, Egypt will have only a small surplus of petroleum for its needs largely to satisfy transport requirements, and no prospect of the development of new reserves to fill its rapidly growing needs for electric power generation.

With respect to the general question of human needs and how best to meet them, the acquisition of a nuclear power capability is judged by the Egyptians to be of vital importance. Its traditional economy, based on the production of food and cotton, is dependent on an irrigation system to insure the adequacy of available agricultural lands. All forecasts indicate the need for new power resources to transport the water expected to be derived from newly discovered underground lakes. In short, without the additional power to be provided by nuclear reactors, there is serious question as to whether there will be enough food available in Egypt in the 1980's.

In the case of Israel, similar analyses project a power shortage in the 1980's.

This projection has been made all the more acute as a result of the return of the Sinai oilfields to Egyptian control. In addition, there is a need for additional cultivable lands. The introduction of nuclear power would contribute greatly to the attainment of greater electric power and water both of which would directly affect the standard of living of all Israelis. In addition, nuclear power will allow Israel to diversify its energy sources, which is of particular importance.

Question 4. Of course, one cannot really say that any one project provides a net gain in economic and human welfare without taking "external cost", as the economists say, explicitly into account. One very major "spillover" or "external cost" of civilian nuclear power is the potential it provides for the production of nuclear weaponry. Can you tell us as precisely as possible how we take this into account?

Answer. The cornerstone of U.S. nuclear cooperation is that this cooperation takes place under effective controls so as to insure that other countries could receive the peaceful benefits of the atom without establishing independent programs which could lead to the development of nuclear weapons. Each agreement for cooperation, including any amendments, must be personally approved by the President in writing on the basis of a determination that the agreement will promote, and not constitute an unreasonable risk to, the common defense and security. Subsequently, each agreement is submitted to the Congress and referred to the Joint Committee on Atomic Energy which reports on it to the Congress. The Congress may prevent the agreement from coming into force by adopting a concurrent resolution to that effect within a thirty day period thereafter.

As noted above, the transactions that take place once an agreement for cooperation comes into force are accomplished under effective controls. These controls consist, essentially, of assurances by other governments that materials and equipment provided by the U.S. will not be used for the production of nuclear weapons or for other military purposes. These assurances are independently verified by safeguards, techniques which have been developed to assure the observance of governmental guarantees regarding peaceful uses of nuclear materials and equipment. These safeguards, which are administered generally by the International Atomic Energy Agency, rely on independent and objective measures, including on-site inspection by personnel from outside the inspected country. IAEA inspectors have the opportunity to routinely visit (in some cases continuously) the facilities under safeguards to verify the accuracy of the reports and records submitted to the Agency, and to perform independent measurements to assist in this determination. In addition, the efforts of the inspectors are reinforced by other surveillance and containment techniques including the use of seals and locks between inspections.

With regard to the effectiveness of this safeguards system, the record speaks for itself. Today, thirty years into the nuclear age, only one country, India, has detonated a nuclear explosion making use of material produced under a program which was substantially assisted by outside sources under arrangements for cooperation in uses of nuclear energy. But even in this use, the arrangements contained no safeguards to verify the use of the research reactor which produced the plutonium. Hence, the Indian nuclear explosion in no way casts doubt on the effectiveness of safeguards.

In summary, therefore, we believe that the "external cost" of civilian nuclear power, when furnished under condition described above, may, in fact, be not a "cost" but a "credit" in terms of deterrence of proliferation.

Question 5. The Exim Bank has, of course, lubricated the sale of this technology by providing heavily subsidized and very attractive loans. So have other export credit agencies in the countries. This subsidy, of course, must be taken into account when we say whether nuclear power is the most economic means of power generation for a recipient country. We would like to ask you the following:

(*a*) Given the dangers of proliferation, does it make sense for the supplier countries to be engaged in this kind of competition?

(*b*) The only compelling reason for a subsidy in international trade is to advance some specific national interest. Why then don't we heavily subsidize alternatives to nuclear power?

Answer. Export-Import Bank guarantees and loans on nuclear projects are made on the Bank's usual terms. Its interest rates are nearly as high as commercial rates and cannot be considered as concessionary. To the extent the Bank's credits are attractive, they are designed to promote U.S. exports by meeting for eign government supported competition. Moreover, similar credits are offered by other nuclear exporting countries under terms which frequently are more favorable than the Export-Import Bank, especially with respect to interest rates.

In considering guaranteed and direct credits for nuclear projects in foreign countries, the Export-Import Bank applies the same rigorous criteria and terms as it does for non-nuclear projects. The projects must make sense economically and be completely credit worthy. Ex-Im interest rates today vary with loan maturity, with nuclear financing going to 9 to 9½ percent, except where it finds it necessary to charge lower rates to meet foreign government-supported competition. The total value of Ex-Im guarantees and credits in any given year may be higher for nuclear programs than others due to the high capital intensity of the former. But, given their cyclical nature, this is not always the case. In some recent years, non-nuclear thermal projects, although not as capital intensive, have exceeded nuclear transactions in terms of Ex-Im dollar involvement. Hence, it is misleadng to imply that the Export-Import Bank discriminates in favor of nuclear projects.

In summary, we believe the economic advantages, both to the recipient country in terms of additional energy sources and the supplier country in terms of the monetary returns realized from sales, argue overwhelmingly in favor of nuclear cooperation, provided it can be carried out under effective controls designed to prevent the diversion of nuclear equipment and supplies to military purposes. On this score, we are satisfied with the safeguard techniques that have evolved over the years, and that are presently being applied by the International Atomic Energy Agency.

Question 6. You mention the desirability of the U.S. remaining active in the nuclear market and say that one advantage of this is that it enables us to exert leverage and control. I think in a certain sense this is true. And yet, don't we also tend to argue, say with regard to the resupply of fuel to India, that we have to continue supplying even though they have exploded a device because we have a commitment. Thus, the incentive to fulfill a commitment outweighs the control. Could you comment?

Answer. The concepts of commitment and leverage in the provision of nuclear equipment and supplies are not dichotomous. In no situation thus far has the United States been confronted with a choice between the two. In the case of the Indian nuclear explosion, no U.S. reactors or fuel were involved. The Canadian facilities that were utilized were supplied under peaceful uses assurances but were not safeguarded. India has provided strong assurances that it was not in violation of its agreement with Canada since the device that it produced was only intended for peaceful purposes. While the U.S., of course, does not favor any proliferation of nuclear weapons or nuclear explosive devices, there was no basis on which we could justify unilaterally abrogating our nuclear agreement with India; which covers only the facility at Tarapur which is safeguarded by the IAEA.

The reliability of our undertakings and commitments is a vital element in making these commitments an effective tool for influencing the programs and policies of other countries in a favorable direction. Commitments which other countries sense may be easily broken on our part are unlikely to persuade such countries to accept the restraints of our Agreements for Cooperation or other proposals designed to deter proliferation. Moreover, the effect of a broken commitment would undoubtedly extend far beyond the country directly involved. Failure of the U.S. to meet one of its nuclear supply undertakings anywhere will undermine the credibility, and thus the persuasive force, of our commitments with all of our partners.

STATEMENTS FOR THE RECORD

STATEMENT OF JEROME D. FRANK, M.D., PROFESSOR EMERITUS OF PSYCHIATRY, JOHNS HOPKINS UNIVERSITY

I appreciate this opportunity to comment on issues raised by House Concurrent Resolution 371 concerning the inability of leaders of the United States and the U.S.S.R., despite their professed intentions, to halt the nuclear arms race, prevent proliferation of nuclear weapons and assure adequate safeguards for transfer of nuclear fuel, technology and equipment to other nations.

As my expertise is in the field of human psychology, I shall consider only some psychological aspects of these problems, recognizing that political, economic and military determinants may be more important. Nor, with some striking exceptions, can national policies be understood through knowledge of the individual psychological characteristics of leaders, who in their official dealings are guided much more by considerations of national interest and the values of the countries they represent than by their individual preferences. The nuclear arms race has been promoted by six Presidents who differed markedly as persons. However, since all policy decisions are made, in the last analysis, by individuals or small groups, certain general psychological principles are pertinent to an understanding of their behavior.

From this standpoint, the inability of leaders of the United States and the U.S.S.R. to break out of an increasingly absurd, dangerous and wasteful nuclear arms race can be understood in terms of the psychology of deterrence on the one hand and force of habit on the other. The essence of deterrence is the attempt of one party to control another by threat of punishment should the latter attempt to perform a forbidden act. As a threat system, deterrence is inherently unstable. Since it depends on rational calculations of both parties as to the relative benefits and costs of performing or refraining from the act in question, it breaks down when the parties possess relatively equal strength and one or the other decides, correctly or incorrectly, that the potential benefits of the action outweigh the probable costs. Furthermore, deterrence policies foster mutual fear and mistrust and when these emotions reach sufficient intensity, rational calculation ceases, as occurred with the Kaiser at the onset of World War I and the Japanese leaders before Pearl Harbor. This is the point, often reached in the past, when the desire to destroy the enemy becomes greater than the desire to stay alive oneself.

A particularly tension-producing consequence of the policy of deterrence is that it fans research and development of weaponry by both sides as each seeks desperately to circumvent the other's defenses while perfecting its own. Since each knows the other is making the same effort, each fears that the other might just possibly achieve a breakthrough which might enable it for a brief period—until the other caught up—to attack with impunity. The more feverish the pace of research and development, the greater the mutual fear, tempting each to try still harder.

Another tension-producing aspect of deterrence is that its effectiveness depends on each side's ability to convince the other of its determination to carry out the threat if necessary. In short, it includes a large component of bluff. As Secretary Kissinger wrote before he was in politics: "Deterrence depends above all on psychological criteria * * *. For purposes of deterrence a bluff taken seriously is more useful than a serious threat interpreted as a bluff."[1] This state of affairs puts a premium on military muscle flexing, belligerent statements and the like.

In this context, disarmament negotiations have virtually no chance of success because proposals that are acceptable to one side are by this very fact unacceptable to the other—"the true, if unavowed aim of every nation that goes into a disarmament conference is to increase its real or relative armament to the detriment of its rivals. Thus 'disarmament' turns out to be but one of the forms the arms race can take."[2] The Helsinki and Vladivostok accords bear witness that Russian and American leaders are still operating on this principle.

For these reasons, deterrence and disarmament negotiations between relatively equal powers have always failed, eventually resulting in war. In wars fought with nonnuclear arms a nation ran some risk of destruction if it lost, but it also could win, thereby enhancing its security and power; so the gamble was worthwhile. Since most nations extant today, including the United States and the U.S.S.R., have been victors in past wars, they continue to rely on the same policies.

Nuclear weapons, because of their totally unprecedented destructive power, have destroyed the premises on which these policies were based. In contrast to nonnuclear weapons, there can be no defense against them. This has two new consequences—beyond a certain point, long passed by the U.S.S.R. and the United States, increasing the nuclear stockpile reduces rather than enhances a nation's safety, and the threat to use them cannot be carried out without destroying the user. As Gen. Curtis LeMay put it: "No one can win a modern war. Even the victor loses." Thus the only purpose of accumulating nuclear weapons is to deter the other side from using them. They are built not to be used, which reduces deterrence to pure bluff.

The assertion that no effective defense against nuclear weapons is possible rests on the psychological consideration that the mental processes involved in devising a defense simultaneously include ways of circumventing it. Moreover, one cannot devise the defense until the mode of attack is clear, so the attacker has a time lead. As a result, no defense against any weapon has been more than about 40 percent effective. With conventional weapons this was tolerable because of their limited destructiveness—with nuclear ones, of course, it is not.

Increasing the nuclear arsenal beyond a certain point does not increase, but rather weakens, a nation's security in three ways: (1) it increases the resulting devastation should deterrence fail; (2) it fans nuclear proliferation among nations, thereby weakening the relative power of the stronger ones; and (3) it increases the likelihood that such weapons will fall into the hands of terrorist or revolutionary groups within a society. It must be emphasized in this connection that because they pack so much destructive force into so small a space, a very few strategically placed nuclear weapons can easily disrupt a highly organized society—imagine, for example, the effects of a nuclear explosion on Capitol Hill during the State of the Union Message. Furthermore, they are not detectable, so a terrorist group could blackmail a city or nation by hiding one set to go off at a later time if their conditions are not met. In short, the nuclear weapon, like the revolver in the Old West, is the great equalizer.

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[1] Kissinger, H. A., Central Issues in American Foreign Policy, in Gordon, K., ed., "Agenda for the Nation," Garden City, New City, N.Y.: Doubleday & Co., 1968; p. 501.

[2] de Madariaga, S., "Disarmament—The Problem Lies Deeper," The New York Times Magazine, Oct. 11, 1959, p. 74.

The effort to develop larger arsenals of ever more sophisticated weapons through pouring funds into research and development, which may have made some sense with conventional weapons, makes none with nuclear ones except as a form of bluffing to convince opponents and allies of the steadfastness of the will of each side to resist "aggression" by the other.

These facts are well known to national leaders. Why, then, do they cling to the policy of nuclear deterrence? Here I think the major psychological factor is the force of habit—the inability to change ingrained ways of thinking and behaving rapidly enough to cope with drastically changed situations. An individual's ways of thinking and behaving are established in childhood and thereafter become the basis of his psychological security by enabling him to predict his own behavior and how others will respond to it. When faced with a brand-new threat, humans inevitably try to deal with it by a familiar way that has worked in the past. The attitudes and behavior of all national leaders today were formed before Hiroshima; hence they try to deal with nuclear weapons as if they were conventional ones, despite their intellectual awareness that they are not.

As to the relative unconcern of national leaders with the danger of nuclear proliferation, one reason may be that this danger is not as real psychologically, because it is indefinite and distant in time. That is, Russia's nuclear arsenal presents the only clear and present danger to the United States at this time. Other possessors of nuclear weapons are either allies, such as France and England, or have too few to pose a threat such as China. Politicians, whose lives have been spent dealing with immediate problems, characteristically let more distant ones wait until they become pressing, so the distant threat posed by nuclear proliferation cannot compete adequately for their attention. Furthermore, at this time we have no idea which of the future nuclear powers to fear, so it is hard to devise a concrete policy to deal with them. Politicians, by and large, are optimists, so they seldom give adequate weight to dangers that are only possibilities.

Most importantly, nonnuclear nations will not indefinitely abjure nuclear weapons in the absence of any sign by the nuclear powers that they seriously intend to scrap theirs. Therefore, only if the U.S.S.R. and the United States succeed in halting their own nuclear proliferation can they hope to prevent other nations from following their lead.

Unfortunately, to do so would directly contravene the policy of becoming or staying "stronger" than the other, to which both are currently committed.

The same considerations apply with greater force to efforts to maintain adequate safeguards surrounding the sale of nuclear powerplants to other nations. The threat is both more remote in time and more uncertain in that the avowed purpose of these plants is the generation of power for peaceful purposes. In contrast to weapons, they confer immediate benefits to the recipients in the form of a rising standard of living. Nor can one predict which nations in the future will actually divert nuclear fuel to weaponry and to what extent. These considerations sharply reduce the supplier's psychological urgency for insisting on safeguards. Finally, and probably by far the strongest incentive to ignore safeguards, is the fact that the market for nuclear reactors is uncontrolled, so that suppliers who insist on the added cost and inconvenience of safeguards are at a competitive economic disadvantage compared with those who do not.

The psychological principle responsible for uncontrolled spread of reactors is that the power of a reward or punishment to control behavior is a function of its nearness in time to the behavior. In this case failure to insist on rigorous standards produces immediate, tangible, and certain financial rewards, while the punishment is indefinitely delayed, unclear and uncertain. Conversely, insisting on safeguards threatens immediate financial loss and brings no corresponding reward other than forestalling of a vague danger in the distant future. Thus it is easy to see which behavior will prevail.

In the light of this analysis, it would appear that moves toward a halt to proliferation of nuclear weapons and maintenance of safeguards against the diversion of nuclear fuel for military purposes require first a halt to the U.S.-U.S.S.R. competition in nuclear arms. This in turn would require a drastic shift in priorities by the leaders of both nations, based on the recognition that a reversal of the arms race carries the only hope of mutual protection from each other and eventually other nations, as well as internal enemies. Whether such a change, which would be analogous in magnitude to a religious conversion, can ever be brought to pass is doubtful to say the least, but a first step toward it would be to try to dispel the atmosphere of mutual distrust that has engendered and is engendered by the arms race. House Concurrent Resolution 371 should help to start this process as a clear statement of intent to halt the arms race by the people and Government of the United States. The ban on underground testing, by hampering research and development, would reduce the mutual fears of technological breakthrough already mentioned. This would improve the climate of negotiations, thereby increasing the chances for agreement on mutual arms reduction.

Unfortunately, by tying all its recommendations to agreements which include adequate verification, the resolution becomes no more than a pious hope, most unlikely to be realized. Its impact would be much stronger if the United States undertook to reduce its arsenal by 20 percent and to stop all underground nuclear explosions unilaterally. While realizing that such a proposal, in the present political climate, has virtually no chance of acceptance, I should like to explain the thinking behind it.

Nuclear weapons have become so complex and various that it is impossible to match reductions with any degree of certainty, nor is an ironclad verification system possible. As a result, neither nation can be sure in any agreement that the other has not gotten the best of the bargain or is not cheating. Given the depth of mutual distrust between the U.S.S.R. and the United States, the goal of reducing armaments by mutual agreement with verification seems a hopeless goal.

At the same time, the U.S. possesses such a superfluity of nuclear arms that a 20 percent reduction and a temporary halt in research and development would have a marginal effect, if any, on our capacity to destroy the U.S.S.R. Under these circumstances, little would be lost and much might be gained by the announcement that the United States would reduce its nuclear stockpile by 20 percent and halt underground testing, without demanding an agreement with the U.S.S.R. to do likewise, but with the expressed expectation that it would make an analogous move to demonstrate the sincerity of its intentions.[1]

This suggestion is based on the plausible assumption that the burdens and dangers of the arms race must be as apparent to the leaders and people of the U.S.S.R. as they are to us, but that fear of our intentions prevents them from moving to halt it, just as our fear of them inhibits us. Hence they might well respond to such a move. If they did not, at least the United States would have increased the credibility of its intentions in the eyes of the rest of the world. If the U.S.S.R. did respond, this could set in train further steps away from the brink of destruction.

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[1] This policy has been worked out in detail by Charles E. Osgood in "An Alternative to War or Surrender" (Urbana, Ill.: University of Illinois Press, Illini Book, 1962).

APPENDIX

TREATY ON THE NON-PROLIFERATION OF NUCLEAR WEAPONS[1]

Done at Washington, London, and Moscow July 1, 1968; Ratification advised by the Senate of the United States of America March 13, 1969; Ratified by the President of the United States of America November 24, 1969; Ratification of the United States of America deposited at Washington, London, and Moscow March 5, 1970; Proclaimed by the President of the United States of America March 5, 1970; Entered into force March 5, 1970

The States concluding this Treaty, hereinafter referred to as the "Parties to the Treaty",

Considering the devastation that would be visited upon all mankind by a nuclear war and the consequent need to make every effort to avert the danger of such a war and to take measures to safeguard the security of peoples,

Believing that the proliferation of nuclear weapons would seriously enhance the danger of nuclear war,

In conformity with resolutions of the United States General Assembly calling for the conclusion of an agreement on the prevention of wider dissemination of nuclear weapons,

Undertaking to cooperate in facilitating the application of International Atomic Energy Agency safeguards on peaceful nuclear activities,

Expressing their support for research, development and other efforts to further the application, within the framework of the International Atomic Energy Agency safeguards system, of the principle of safeguarding effectively the flow of source and special fissionable materials by use of instruments and other techniques at certain strategic points,

Affirming the principle that the benefits of peaceful applications of nuclear technology, including any technological by-products which may be derived by nuclear-weapon States from the development of nuclear explosive devices, should be available for peaceful purposes to all Parties to the Treaty, whether nuclear-weapon or non-nuclear-weapon States,

Convinced that, in furtherance of this principle, all Parties to the Treaty are entitled to participate in the fullest possible exchange of scientific information for, and to contribute alone or in cooperation with other States to, the further development of the applications of atomic energy for peaceful purposes,

Declaring their intention to achieve at the earliest possible date the cessation of the nuclear arms race and to undertake effective measures in the direction of nuclear disarmament,

Urging the cooperation of all States in the attainment of this objective,

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[1] 21 UST 483; TIAS 6839. As of January 1, 1975, the following countries had deposited instruments of ratification, accession, or notification of succession: Afghanistan, Australia, Austria, Bolivia, Botswana, Bulgaria, Burundi, Cameroon, Canada, Central African Republic, Chad, China (Republic of), Costa Rica, Cyprus, Czechoslovakia, Dahomey, Denmark, Dominican Republic, Ecuador, El Salvadore, Ethiopia, Fiji, Finland, Gabon, German Democratic Republic, Ghana, Greece, Guatemala, Haiti, Holy See, Honduras, Hungary, Iceland, Iran, Iraq, Ireland, Ivory Coast, Jamaica, Jordan, Kenya, Khmer Republic, Laos, Lebanon, Lesotho, Liberia, Madagascar, Malaysia, Maldives, Mali, Malta, Mauritius, Mexico, Mongolia, Morocco, Nepal, New Zealand, Nicaragua, Nigeria, Norway, Paraguay, Peru, Philippines, Poland, Romania, San Marino, Senegal, Somalia, Sudan, Swaziland, Sweden, Syrian Arab Republic, Thailand, Togo, Tonga, Tunisia, Union of Soviet Socialist Republics, United Kingdom, United States, Upper Volta, Uruguay, Viet-Nam, Yugoslavia, and Zaire.

As of January 1, 1975, the following countries have signed, but have not yet ratified the Treaty: Barbados, Belgium, Colombia, Egypt, Gambia, Germany (Federal Republic of), Indonesia, Italy, Japan, Korea (Republic of), Kuwait, Libya, Luxembourg, Netherlands, Panama, Singapore, Sri Lanka, Switzerland, Trinidad and Tobago, Turkey, Venezuela, Yemen (Aden), and Yemen (San'a').

Recalling the determination expressed by the Parties to the 1963 Treaty Banning Nuclear Weapon Tests in the Atmosphere in Outer Space and Under Water[2] in its Preamble to seek to achieve the discontinuance of all test explosions of nuclear weapons for all time and to continue negotiations to this end,

Desiring to further the easing of international tension and the strengthening of trust between States in order to facilitate the cessation of the manufacture of nuclear weapons, the liquidation of all their existing stockpiles, and the elimination from national arsenals of nuclear weapons and the means of their delivery pursuant to a treaty on general and complete disarmament under strict and effective international control.

Recalling that, in accordance with the Charter of the United Nations,[3] States must refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any State, or in any other manner inconsistent with the Purposes of the United Nations, and that the establishment and maintenance of international peace and security are to be promoted with the least diversion for armaments of the world's human and economic resources,

Have agreed as follows:

ARTICLE I

Each nuclear-weapon State Party to the Treaty undertakes not to transfer to any recipient whatsoever nuclear weapons or other nuclear explosive devices or control over such weapons or explosive devices directly, or indirectly; and not in any way to assist, encourage, or induce any non-nuclear-weapon State to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices, or control over such weapons or explosive devices.

ARTICLE II

Each non-nuclear-weapon State Party to the Treaty undertakes not to receive the transfer from any transferor whatsoever of nuclear weapons or other nuclear explosive devices or of control over such weapons or explosive devices directly, or indirectly; not to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices; and not to seek or receive any assistance in the manufacture of nuclear weapons or other nuclear explosive devices.

ARTICLE III

1. Each non-nuclear-weapon State Party to the Treaty undertaken to accept safeguards, as set forth in an agreement to be negotiated and concluded with the International Atomic Energy Agency in the cordance with the Statue of the International Atomic Energy Agency and the Agency's safeguards system, for the exclusive purpose of verification of the fulfillment of its obligations assumed under this Treaty with a view to preventing diversion of nuclear energy from peaceful uses to nuclear weapons or other nuclear explosive devices. Procedures for the safeguards required by this article shall be followed with respect to source or special fissionable material whether it is being produced, processed or used in any principal nuclear facility or is outside any such facility. The safeguards required by this article shall be applied on all source or special fissionable material in all peaceful nuclear activities within the territory of such State, under its jurisdiction, or carried out under its control anywhere.

2. Each State Party to the Treaty undertakes not to provide: (a) source or special fissionable material, or (b) equipment or material especially designed or prepared for the processing, use or production of special fissionable material, to any non-nuclear-weapon State for peaceful purposes, unless the source or special fissionable material shall be subject to the safeguards required by this article.

3. The safeguards required by this article shall be implemented in a manner designed to comply with article IV of this Treaty, and to avoid hampering the economic or technological development of the Parties or international cooperation in the field of peaceful nuclear activities, including the international exchange of nuclear material and equipment for the processing, use or production of nuclear material for peaceful purposes in accordance with the provisions of this article and the principle of safeguarding set forth in the Preamble of the Treaty.

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[2] See page 1146 of text.

[3] See page 617 of text.

4. Non-nuclear-weapon States Party to the Treaty shall conclude agreements with the International Atomic Energy Agency to meet the requirements of this article either individually or together with other States in accordance with the Statute of the International Atomic Energy Agency. Negotiation of such agreements shall commence within 180 days from the original entry into force of this Treaty. For States depositing their instruments of ratification or accession after the 180-day period, negotiation of such agreements shall commence not later than the date of such deposit. Such agreements shall enter into force not later than eighteen months after the date of initiation of negotiations.

ARTICLE IV

1. Nothing in this Treaty shall be interpreted as affecting the inalienable right of all the Parties to the Treaty to develop research, production and use of nuclear energy for peaceful purposes without discrimination and in conformity with articles I and II of this Treaty.

2. All the Parties to the Treaty undertake to facilitate, and have the right to participate in, the fullest possible exchange of equipment, materials and scientific and technological information for the peaceful uses of nuclear energy. Parties to the Treaty in a position to do so shall also cooperate in contributing alone or together with other States or international organizations to the further development of the applications of nuclear energy for peaceful purposes, especially in the territories of non-nuclear-weapon States Party to the Treaty, with due consideration for the needs of the developing areas of the world.

ARTICLE V

Each Party to the Treaty undertakes to take appropriate measures to ensure that, in accordance with this Treaty, under appropriate international observation and through appropriate international procedures, potential benefits from any peaceful applications of nuclear explosions will be made available to non-nuclear-weapon States Party to the Treaty on a non-discriminatory basis and that the charge to such Parties for the explosive devices used will be as low as possible and exclude any charge for research and development. Non-nuclear-weapon States Party to the Treaty shall be able to obtain such benefits, pursuant to a special international agreement or agreements, through an appropriate international body with adequate representation of non-nuclear-weapon States. Negotiations of this subject shall commence as soon as possible after the Treaty enters into force. Non-nuclear-weapon States Party to the Treaty so desiring may also obtain such benefits pursuant to bilateral agreements.

ARTICLE VI

Each of the Parties to the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament and on a treaty on general and complete disarmament under strict and effective international control.

ARTICLE VII

Nothing in this Treaty affects the right of any group of States to conclude regional treaties in order to assure the total absence of nuclear weapons in their respective territories.

ARTICLE VIII

1. Any Party to the Treaty may propose amendments to this Treaty. The text of any proposed amendment shall be submitted to the Depositary Governments which shall circulate it to all Parties to the Treaty. Thereupon, if requested to do so by one-third or more of the Parties to the Treaty, the Depositary Governments shall convene a conference, to which they shall invite all the Parties to the Treaty, to consider such an amendment.

2. Any amendment to this Treaty must be approved by a majority of the votes of all the Parties to the Treaty, including the votes of all nuclear-weapon States Party to the Treaty and all other Parties which, on the date the amendment is circulated, are members of the Board of Governors of the International Atomic Energy Agency. The amendment shall enter into force for each Party that deposits its instrument of ratification of the amendment upon the deposit of such

instruments of ratification by a majority of all the Parties, including the instruments of ratification of all nuclear-weapon States Party to the Treaty and all other Parties which, on the date the amendment is circulated, are members of the Board of Governors of the International Atomic Energy Agency. Thereafter, it shall enter into force for any other Party upon the deposit of its instrument of ratification of the amendment.

3. Five years after the entry into force of this Treaty, a conference of Parties to the Treaty shall be held in Geneva, Switzerland, in order to review the operation of this Treaty with a view to assuring that the purposes of the Preamble and the provisions of the Treaty are being realized. At intervals of five years thereafter, a majority of the Parties to the Treaty may obtain, by submitting a proposal to this effect to the Depositary Governments, the convening of further conferences with the same objective of reviewing the operation of the Treaty.

ARTICLE IX

1. This Treaty shall be open to all States for signature. Any State which does not sign the Treaty before its entry into force in accordance with paragraph 3 of this article may accede to it at any time.

2. This Treaty shall be subject to ratification by signatory States. Instruments of ratification and instruments of accession shall be deposited with the Governments of the United States of America, the United Kingdom of Great Britain and Northern Ireland and the Union of Soviet Socialist Republics, which are hereby designated the Depositary Governments.

3. This Treaty shall enter into force after its ratification by the States, the Governments of which are designated Depositaries of the Treaty, and forty other States signatory to this Treaty and the deposit of their instruments of ratification. For the purposes of this Treaty, a nuclear-weapon State is one which has manufactured and exploded a nuclear weapon or other nuclear explosive device prior to January 1, 1967.

4. For States whose instruments of ratification or accession are deposited subsequent to the entry into force of this Treaty, it shall enter into force on the date of the deposit of their instruments of ratification or accession.

5. The Depositary Governments shall promptly inform all signatory and acceding States of the date of each signature, the date of deposit of each instrument of ratification or of accession, the date of the entry into force of this Treaty, and the date of receipt of any requests for convening a conference or other notices.

6. This Treaty shall be registered by the Depositary Governments pursuant to article 102 of the Charter of the United Nations.[4]

ARTICLE X

1. Each Party shall in exercising its national sovereignty have the right to withdraw from the Treaty if it decides that extraordinary events, related to the subject matter of this Treaty, have jeopardized the supreme interests of its country. It shall give notice of such withdrawal to all other Parties to the Treaty and to the United Nations Security Council three months in advance. Such notice shall include a statement of the extraordinary events it regards as having jeopardized its supreme interests.

2. Twenty-five years after the entry into force of the Treaty, a conference shall be convened to decide whether the Treaty shall continue in force indefinitely, or shall be extended for an additional fixed period or periods. This decision shall be taken by a majority of the Parties of the Treaty.

ARTICLE XI

This Treaty, the English, Russian, French, Spanish and Chinese texts of which are equally authentic, shall be deposited in the archives of the Depositary Governments. Duly certified copies of this Treaty shall be transmitted by the Depositary Governments to the Governments of the signatory and acceding States.

IN WITNESS WHEREOF the undersigned, duly authorized, have signed this Treaty.

DONE in triplicate, at the cities of Washington, London and Moscow, the first day of July one thousand nine hundred sixty-eight.

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[4] See page 638 of text.

GENERAL BACKGROUND INFORMATION

(Background paper prepared by Congressional Research Service of the Library of Congress.)

THE SPREAD OF NUCLEAR WEAPONS

The monopoly which the United States held on the technology for nuclear weapons was broken when the Soviet Union exploded its first atomic bomb in August 1949. Two years later the United States shared its atomic know-how with the United Kingdom. France developed a capability independently and carried out its first nuclear test in 1960. Communist China followed with its first test in 1964.

Thus five major nations became nuclear weapons powers. By that time, so many nuclear weapons and materials had been produced and stockpiled that it was no longer possible to have assurance they would all be disposed of, even if nations could have agreed to abolish them.

The expectation that the number of nuclear powers might expand to 20 or 30 was an alarming prospect and it became evident to both nuclear and nonnuclear powers that steps to stop the proliferation of nuclear weapons to any additional countries must be pursued urgently.

The problem was addressed by the 1968 Treaty on the Non-Proliferation of Nuclear Weapons (NPT). Today, 97 States are Parties to the NPT, and an additional 14 States have signed but not yet ratified.

Nuclear weapon States Party to the NPT (i.e., the U.S., the U.K., and the U.S.S.R.) undertake not to export nuclear weapons, nuclear explosive devices, or nuclear fuel, reactors, or equipment, to any non-nuclear weapon state in which such exports will not be subject to IAEA safeguards. The Non-Nuclear Weapon States have undertaken not to accept the transfer of nuclear weapons or nuclear explosive devices, or to develop or possess the same. They also have pledged to accept IAEA safeguards or all nuclear activities in their territories.

Additionally, the NPT is designed to:

- provide assurance, through international safeguards, that the peaceful nuclear activities of states which have not already developed nuclear weapons will not be diverted to making such weapons;
- promote, to the maximum extent consistent with the other purposes of the treaty, the peaceful uses of nuclear energy through full cooperation--with the potential benefits of peaceful nuclear explosion technology being made available to nonnuclear parties through international procedures;
- express the determination of the parties that the treaty should lead to further progress in comprehensive arms control and nuclear disarmament measures.

At the time that the NPT opened for signature, a variety of questions arose, both technical and political. Would the treaty relegate non-nuclear nations permanently to a second-class status? Would the nuclear powers match the renunciation of nuclear weapons asked of the nonnuclear nations with at least some move toward reduction in their own arsenals? Of paramount importance to the nonnuclear nations was the question, would their security be assured if they renounced nuclear weapons? To many countries it seemed quite evident that greater security was to be found in an international nonproliferation regime than in running the risks of nuclear rivalry. Nevertheless, further assurance was sought.

The matter of security assurances was addressed by the Security Council--the body of the United Nations bearing the primary responsibility for maintenance of international peace and security. Following an initiative proffered jointly by the United States, the United Kingdom, and the Soviet Union, the Security Council, in June of 1968, approved a resolution which welcomed the intention expressed by these countries that they would come to the assistance of any nonnuclear country that was threatened by the use of nuclear weapons.

INTERNATIONAL SAFEGUARDS

The material originally used in the fabrication of nuclear weapons was the fissionable isotope of uranium, U^{235}, but this isotope had to be enriched from its concentration in natural uranium, about 0.7 percent, to greater than 90 percent to be used in bombs. Enrichment plants of the type utilized by the nuclear powers thus far are very large, very expensive, and require very sophisticated technology. On the other hand, uranium used in certain types of nuclear reactors which produce electricity does not have to be enriched at all, although the reactors designed by the United States for the commercial production of electricity use slightly enriched uranium; that is, the fuel contains about 4 percent U^{235}.

One might suppose, therefore, that a given nation might develop a program of reactors for peaceful purposes, using natural or [illegible]-enriched uranium, without the danger of developing a nuclear weapons capability. In the process of nuclear fission, however, plutonium is produced as a by-product. Plutonium is a new, man-made element--it is not found in nature. It is also a fissionable material and can be a used to fuel a reactor, just as the original uranium was used. The danger lies in the fact that plutonium can also be used for bombs. It must be separated from uranium, but this can be done by a chemical process which, compared to the process for enriching uranium, is a relatively easy and inexpensive way to acquire fissionable material for weapons use. There are now over 100 reactors in the world which produce electricity--and plutonium. In the next few years, as the world's energy requirements increase, this figure is expected to quadruple.

Although it is generally assumed that a country wishing to take the nuclear weapons road would use plutonium, there is another possibility. A relatively new technique, using centrifuges, may make the enrichment of uranium more feasible. A centrifuge plant is much smaller and less costly than the huge gaseous diffusion plant that the nuclear powers thus far have used to produce weapons-grade uranium in large quantities. The centrifuge process has proved to be effective, although the economics are not yet proven. Still another possibility involves the use of lasers to enrich uranium.

During the negotiations on the nonproliferation treaty drafts, there was acceptance by all concerned that facilities and materials devoted to peaceful purposes must be under safeguards to insure that plutonium would never be clandestinely diverted to the manufacture of nuclear weapons. The controversy centered around the question of how the safeguards procedures would be administered.

The treaty as finally agreed upon stipulates that nonnuclear parties would conclude safeguards agreements with the International Atomic Energy Agency (IAEA), either individually or together with other states. This latter option permits EURATOM, the organization established by the nine European Common Market countries as a pool for nuclear energy activities, to enter into an agreement with IAEA as a group.

THE INTERNATIONAL ATOMIC ENERGY AGENCY

The IAEA, with headquarters in Vienna, was established under the auspices of the United Nations in 1957. It is the outgrowth of the Atoms-for-Peace proposal made by President Eisenhower in 1953, when he called for "international control of atomic energy to promote its use for peaceful purposes only . . . under adequate safeguards, including a practical system of inspection under the United Nations."

The IAEA is a self-governing organization but has direct reporting links with the U.N. General Assembly and Security Council, as well as cooperative arrangements with sister agencies of the United Nations concerned with radiological aspects of world health, food and agriculture, and theoretical physics. It is financed by its 110 member nations. The U.S. contribution for calendar year 1975 is $7.4 million, approximately 32 percent of the total budget; in addition, the U.S. voluntarily contributed a further $1.1 million in cash and $1.4 million of gifts in kind to the Agency. The staff numbers about 1,000 including scientists and technicians who devise and implement safeguards techniques and inspections.

The Treaty on the Nonproliferation of Nuclear Weapons (NPT) was opened for signature on July 1, 1968, and entered into force on March 5, 1970, when a sufficient number of countries had ratified to meet the requirement for entry into force. The Board of Governors of the IAEA moved quickly to establish a Safeguards Committee to advise the Board on the agreements to be negotiated and to discuss the problem of safeguards financing.

Membership in the Safeguards Committee was open to all members of the IAEA. Forty-seven states actually participated, including nearly all states represented on the Board of Governors of the IAEA, all members of that Agency which are nuclear-weapon states, all of the world's nuclear industrial states, all members of EURATOM except Luxembourg (which has no atomic energy program), and a number of developing countries.

The Committee began its work in June 1970, and by May 1971 had published a "blueprint" to govern the agreements to be entered into between nonnuclear parties to the NPT and the IAEA. Considering the wide disparity of interests represented in the Committee and the immense complexity of the task of defining safeguards requirements suitable for application to countries in all parts of the world, the accomplishment was a truly remarkable example of cooperation among nations in establishing an international regime of inspection.

It was clear that IAEA inspectors would face problems far more difficult than those routinely encountered by domestic safeguards inspectors. IAEA safeguards must insure the highest degree of confidence that peaceful nuclear activities are in accordance with agreements, while at the same time sensitivities relating to national sovereignty must be taken into consideration. The United States, through the Arms Control and Disarmament Agency and the Atomic Energy Commission (and its successors, NRC and ERDA), has been of substantial assistance to the IAEA in working out procedures which are both effective and nonintrusive.

SAFEGUARDS RESEARCH

The Arms Control and Disarmament Agency alone, since 1968, has expended more than $5 million on research and development of safeguards and equipment.

The work in this field falls into four main categories:

1. The development of portable instrumentation;

2. The development of tamper-resistant, unattended safeguards surveillance instrumentation;

3. The development of safeguards seals;

4. The development of advanced techniques for verifying the plutonium production of reactors.

NPT REVIEW

Today there are 97 parties to the NPT, and an additional 14 nations have signed but not yet ratified.

At the Review Conference of the Parties to and Signatories of the NPT held in May of this year, the U.S. joined other States in reaffirming support for the treaty regime. Notably, the Conference urged supplier States to strengthen common export requirements, and recommended that IAEA safeguards be strengthened and universally applied in the treaty context. The Conference recognized that regional or multinational nuclear fuel-cycle centers may be an advantageous way to satisfy, safely and economically, the nuclear power program needs of many States. It was also urged that concrete recommendations for the physical protection of nuclear materials in use, storage and transit be elaborated.

As of December 31, 1974, there were 83 parties to the NPT and 25 other signatories which had not yet ratified it. There had been virtually no movement toward adherence for several years, and none since the Indian explosion in May, 1974. With the stimulus of the NPT Review Conference, this picture changed dramatically. In the weeks preceding the Conference, the Treaty was ratified by the Federal Republic of Germany, Italy, the Netherlands, Belgium, Luxembourg, and the Republic of Korea, and it was submitted to the Japanese Diet for ratification. Three ratifications including that of Libya occurred during the Conference. By the time the Conference closed, there were 96 parties to the NPT and 15 other signatory states, in several of which the ratification process was in train. The Conference included in its Final Declaration statements which the Japanese Government considered important to its ratification process. Moreover, by deciding to accept the attendance of South Africa as an observer, the Conference avoided a serious setback to efforts to encourage that country to join the Treaty. Venezuela recently became the 97th NPT Party.

The explosion of a nuclear device by India--which is not a signatory to the Nonproliferation Treaty--in May of 1974 drew new attention to the problem. Although a score of nations with the economic and technical potential for producing nuclear weapons had not become parties to the NPT, 10 years had passed without an additional nation testing nuclear explosives.

PNEs AND NON-PROLIFERATION

Article V of the Non-Proliferation Treaty provides for the availability of the potential benefits of nuclear explosions for peaceful purposes (PNEs) on a non-discriminatory basis to the non-nuclear weapon states. The Article was incorporated into the Treaty because of the impossibility of acquiring a capability to make nuclear explosive devices for peaceful purposes without at the same time acquiring a nuclear weapons capability. Since non-nuclear weapon states could not, therefore, develop nuclear explosives for peaceful purposes and remain non-nuclear, any benefits from PNEs would be provided to the non-nuclear weapon states.

Despite large expenditures for research and development, PNEs have not been put to commercial use in the U.S., and the U.S. PNE research and development program has essentially stopped. Moreover, it has become clear that PNEs may be a major stumbling block to the attainment of a comprehensive ban on nuclear testing because of the indistinguishability of the technologies of nuclear explosive devices for peaceful and for weapons purposes.

Thus, if a comprehensive ban is to be achieved (and the obliation of the nuclear weapon states under Article VI of the NPT to negotiate effective measures relating to the cessation of the nuclear arms race", which many non-nuclear weapon states have equated with negotiating a CTB is to be fulfilled) it may be necessary to forego PNEs altogether, and whatever potential benefits they may have, in order to achieve the greater benefits of a comprehensive ban for (a) restraining further proliferation by removing a most visible manifestation of differences between nuclear and non-nuclear weapon states and (b) restraining the arms competition between nuclear weapon states.

MULTINATIONAL REGIONAL NUCLEAR FUEL CYCLE CENTERS

For some time, ACDA and other agencies of government that deal with non-proliferation issues have been increasingly concerned about the problem of dealing with the rapidly growing quantities of plutonium being produced in nuclear reactors. If such plutonium is separated from the spent reactor fuel in a chemical reprocessing plant, it can pose serious risks of theft or seizure by terrorists and of potential diversion to nuclear explosives. While very few chemical reprocessing plants have been built to date, and the current commercial need for them is by no means clear, an increasing number of countries have shown an interest in acquiring national plants of this type.

One means of coping with this problem would be to devise alternatives to national reprocessing, particularly through the establishment of regional fuel cycle centers, multinational in scope and control, and under full and stringent international safeguards. ACDA led a major interagency study to investigate this concept. That study came to several key preliminary conclusions: (1) at least in the short run, storage of spent fuel is cheaper than reprocessing; (2) as the price of nuclear fuel and enrichment rise, reprocessing of plutonium may become economically viable. However, because of economics of scale, that would only be the case if done on a large scale beyond the capabilities of almost any single nation; (3) large multinational plants would be easier to safeguard than a small number of many small plants; and (4) though many technical, legal, environmental and political problems would have to be solved, these factors appear to indicate substantial economic and non-proliferation advantages for large-scale, multi-national regional centers.

A study of such centers was recommended by the NPT Review Conference last May. Since then, the International Atomic Energy Agency has begun an ambitious study of the concept, which the United States is strongly encouraging and supporting. A further boost to the project was given by Secretary Kissinger in his most recent speech to the United Nations General Assembly, in which he stated:

> "The greatest single danger of unrestrained nuclear proliferation resides in the spread under national control of reprocessing facilities for the atomic materials in nuclear power plants. The United States therefore proposes -- as a major step to reinforce all other measures -- the establishment of multinational regional nuclear fuel cycle centers. These centers would serve energy needs on a commercially sound basis and encourage regional energy cooperation. Their existence would reduce the incentive for small inefficient reprocessing facilities, limit the possibility of diverting peaceful nuclear materials to national military use, and create a better framework for applying effective international safeguards.
>
> "We urge that groups of nations begin now to explore this concept and that all states support the IAEA's work in this field."

NUCLEAR EXPORTS

By article III.2 of the NPT, the U.S. has undertaken (in addition to the article I ban on the transfer of nuclear weapons or nuclear explosive devices) not to provide source or special fissionable material (e.g., plutonium and uranium in the isotopes U^{233} or U^{235}), nor equipment or material "especially designed or prepared for the processing, use of production of special fissionable material to any non-nuclear weapon State for peaceful purposes, unless the source or special fissionable material shall be subject to the safeguards required by this article."

Several agencies of the U.S. Government monitor and regulate nuclear exports from the U.S. in order to ensure that this obligation is fully met. Among these agencies are the U.S. Arms Control and Disarmament Agency, the Departments of State and of

Commerce, the Nuclear Regulatory Commission, the U.S. Energy Research and Development Administration, and the National Security Council.

U.S. nuclear exports are presently controlled by the Atomic Energy Act of 1954, as amended, the Export Administration Act of 1969, as amended, and the terms of U.S. agreements for cooperation in civil uses of atomic energy with 28 other governments in conjunction with the NPT.

By these means, the U.S. interests in ensuring that U.S. exports are used solely for peaceful purposes and concommitant U.S. non-proliferation concerns are protected.

INTER-AGENCY COORDINATION

As described by the President in his report of May 6 to the Congress on Laws and Regulations Governing Nuclear Exports and Domestic and International Safeguards, pursuant to the Export Administration Act of 1969, as amended, "applications made to the Department of Commerce for the export of (nuclear) items are referred to ERDA, DOD and State for review and appropriate action before any action is taken by the Commerce Department on the proposed export." In addition, ACDA participates on occasion in such review.

On NRC licenses, the above agencies are consulted where the grant of such license has the effect of authorizing nuclear exports. When the Export-Import Bank considers making a preliminary commitment to offer financial assistance to implement nuclear exports, the Bank consults with the above agencies before making a preliminary commitment.

On other issues of nuclear export, Executive Branch policy is coordinated amongst State, Commerce, ERDA, and ACDA by the National Security Council.

Commercial Nuclear Power and Nuclear Proliferation

Steven J. Baker

Research Associate
Peace Studies Program
Cornell University

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Steven J. Baker holds a doctorate in political science from the University of California at Los Angeles. Dr. Baker's paper was written while he was a post-doctoral Research Associate of the Peace Studies Program of Cornell University's Center for International Studies.

Commercial Nuclear Power and Nuclear Proliferation

INTRODUCTION

In the last year concern has grown over the implications of nuclear energy exports: intense competition among advanced industrial countries to export nuclear reactors, fuels, and fuel processing facilities has increased fears about accelerating the acquisition of nuclear weapons capabilities in Third World countries. This concern has reportedly generated an examination of the possibility of a common approach to the problem of nuclear exports on the part of some of the nuclear exporting nations--the United States, Britain, the Soviet Union, France, West Germany, Canada, Japan, and Italy.

In the United States, congressional concern has resulted in a proposal to revise the standards and procedures governing nuclear exports. Opposition to these unilateral restrictions is strong in various parts of the bureaucracy, in the Joint Committee on Atomic Energy, and in the nuclear industry.

This paper surveys the development of the international nuclear energy market, with particular reference to America's role in this process. The emphasis is on the interplay between the commercial promotion of nuclear energy and the proliferation of nuclear weapons, between domestic and foreign policies, and the implications of domestic energy policy choices for future nuclear weapons proliferation.

COMMERCIAL NUCLEAR POWER AND NUCLEAR PROLIFERATION

India has demonstrated in practice what has always been recognized in principle: a nuclear weapons option may be spun-off from a peaceful nuclear energy program.[1] Whereas the nuclear energy programs of the first five nuclear weapons states were the outgrowth of essentially military programs, India's point of departure was a civil nuclear program[2] and as such represents an important and portentous variant in nuclear proliferation.

The danger inherent in the international spread of nuclear energy was recognized from the beginning. The Soviet Union and the United States have sought to deal with this danger in two interrelated ways: generally to create the international political conditions in which there would be little incentive to exercise a weapons option; and more specifically, to erect an international web of technical dependency relationships that would allow them to control the domestic nuclear development of other nations.

Neither of these approaches has been completely successful. By maintaining nuclear weapons as a permanent part of the calculus of national power, the superpowers have perpetuated the incentive for other nations to consider a nuclear option. The export of nuclear technology has given the superpowers some influence in the promotion of certain lines of nuclear technology, but has been less effective in blocking lines of technology which they did not favor. These

Footnotes appear on p. 330.

policies have not diminished the incentives to go nuclear, but they have accelerated other nations' acquisition of nuclear weapons capabilities.

These trends are likely to be accentuated in the future as a result of the widespread commercialization of nuclear energy. The political and economic conditions resulting from the creation of an international nuclear energy industry have become important parameters that further complicate the task of nuclear arms control, parameters that tend to be underestimated in arms control studies. Domestic politics and national economic interests are involved in any nonproliferation measure. It is important to understand how far this process has gone and why, as a prelude to considering the policy alternatives in a world in which nuclear nonproliferation objectives are increasingly conditioned by economic considerations.

THE INTERNATIONAL NUCLEAR MARKET

The present contribution of nuclear energy to meeting the world's demand for electricity is still rather limited. While there are hundreds of small research reactors around the world, there are only about 130 power reactors producing electricity in about eighteen nations, numbers that will double as new reactors start up in the next four or five years.[3] Similarly, nuclear fuel plants are still relatively few in number: for example, there are only thirteen nations in the world that have either experimental or industrial scale fuel reprocessing facilities.[4]

These figures represent little more than the prototype stage of the nuclear industry; until the dramatic increase in the price of oil following the Arab-Israeli war of 1973, nuclear power was at best marginally economically competitive with conventional energy sources. But in the wake of the oil crisis most of the world's industrial nations projected heavy increases in reliance on nuclear power,[5] and for the first time nuclear energy was being promoted in very small-sized plants as an economically viable source of electricity for developing countries.[6]

The international market for nuclear energy technology, hardware, and nuclear fuels is projected to grow enormously. Estimates of the dollar value of this market vary, but all are impressive: one, an industry set of projections for the period 1971 to 1985, estimates a $250 billion investment in reactors worldwide, with an additional $45 billion to be invested in uranium mining, milling, enrichment, fuel fabrication, and reprocessing.[7] The existence of this kind of international market, and the commitment by governments and private firms of enormous financial resources to exploit this market, constitute a set of political facts of the highest importance. Energy supplies have moved to the center of national and international political concerns. Political desires for maximum national independence in energy (or more aptly, maximum diversity in forms of dependence) often conflict with national economic priorities--national independence promises to be more expensive in the short run than reliance on imported fuels. And in a competitive international environment, profit-oriented strategies of nuclear industries, some of which are extensions of multinational corporations, may not coincide with the political and economic goals of governments but must nonetheless be taken into account by government policy makers.

The result is an international situation marked by intense commercial competition among technologically advanced nations, an atmosphere that is scarcely conducive to arms control measures. Even where there is substantial government commitment to the objective of nuclear nonproliferation, sub-governmental bureaucratic and political groups and non-governmental organizations may be pursuing interests that in effect contradict arms control objectives. Arms control policies must increasingly adjust to a situation in which "low politics" kinds of considerations involving economic welfare impinge on "high politics" kinds of considerations involving national security: increasingly, we are compelled to adjust to what has been called the "vulgarization of the atomic enterprise."[8]

COMMERCIALIZATION OF NUCLEAR ENERGY IN THE UNITED STATES

American policies are primarily responsible for the creation of an international nuclear market with its present characteristics. Although nuclear science was international before World War II (scientists of thirteen nations worked on the Manhattan project[9]) the manner in which science was harnessed to industrial capacity to achieve political goals is perhaps peculiarly American. The wartime pattern of interpenetrating government bureaucracies, university research facilities, and industrial enterprises was perpetuated into the postwar period. This made the development of nuclear energy a kind of prototype of the phenomenon loosely termed the "military-industrial complex."

The United States was instrumental in shaping the competitive international environment that frustrated attempts at achieving international controls on nuclear weapons. The permanent American advantage in nuclear technology that the Baruch Plan would have given to the United States was clearly unacceptable to the Soviet Union, and had it been accepted by the Soviet government, it is not clear that it would have been acceptable to the American Congress.[10] In the absence of an international regime, nuclear weapons became a permanent part of the calculus of national power, with the emergence over time of successive nuclear weapons states.

The peaceful atom became no less a tool of national policy than the atomic bomb, and American predominance in the non-communist world helped shape the international spread of nuclear energy. While national security concerns dominated, calculations of national commercial advantage were present from the first in nuclear technology. Even during World War II the issue of postwar commercial rights to civil nuclear applications contributed to the breakdown in cooperation between the United States and Great Britain in 1943[11] and later the question of postwar patent rights complicated the problem of the repatriation of French scientists who had worked on bomb-related projects in Canada.[12]

In the postwar period, the American government became committed to the development of the peaceful uses of nuclear energy. While the 1946 McMahon Act includes the exhortation to "further private enterprise," the dominant role assigned to the federal government in nuclear affairs was unprecedented in peacetime. Civil applications of nuclear science were judged to be essential to continuing work on the atomic bomb, since nuclear scientists tended to justify their work on the latter in terms of their contributions to the former.[13] American industry was initially reluctant to become involved in nuclear projects, given the scant prospects for immediate industrial applications and rigid government controls. But ample government financial support, especially in research and development, helped overcome industry's initial diffidence.[14] This same government investment in civil nuclear research and development helped create a permanent government interest in promoting the commercialization of nuclear energy in order to redeem the promises made to the private sector and to redeem the government's own considerable commitment.[15]

The creation of the Atomic Energy Commission was crucial. The emergence of an effective, expansive bureaucratic actor assured that the interests of nuclear energy would be pursued within the government.[16] And the political support of important Congressional leaders, concentrated in the Joint Committee on Atomic Energy, provided a critical link between private interests and bureaucratic policy.[17] These several sources of nuclear policy were often at odds with one another over questions like public versus private power.[18] But there was also a minimal agreement on a common goal: that nuclear energy should be promoted to the point where it was a commercially viable technology, a dependable alternative to coal and oil as a means of generating electricity. Despite persistent differences, the agreement of disparate groups on this general goal was sufficient to give American nuclear energy policy in the 1950s and early 1960s a certain coherence and effectiveness. It was this policy that allowed the United States to establish itself as the dominant force in the world nuclear energy market.

THE UNITED STATES AND THE INTERNATIONAL SPREAD OF NUCLEAR ENERGY

These domestic interests are sufficient to account for the government's attempts to promote the commercialization of nuclear energy, but not its internationalization. Indeed, in the wake of the rejection of the Baruch Plan and with the 1946 McMahon Act, the trend was in the opposite direction. Under the policy of nuclear secrecy, nuclear sharing with Great Britain and Canada was terminated and the United States consciously sought to preserve its nuclear weapons monopoly through a policy of restricted access to nuclear technology.

It is generally conceded that the policy of nuclear secrecy was a failure. The Russian detonation of an A-bomb in 1949 and the British A-bomb detonation in 1952 confirmed this proposition.[19] But at a distance of twenty-five years, the conclusion that the United States should actively promote the international spread of nuclear reactors because the Soviet Union and Great Britain had exploded nuclear weapons requires some explanation.

In the narrowest sense, nuclear secrecy had failed to prevent others from acquiring nuclear weapons. But in order to develop independently a nuclear weapons capability, the Soviet Union and Britain had had to make enormous economic and technical exertions, many of which merely duplicated American efforts. Their achievements were as much as anything an example of the staggering costs of breaking the American nuclear monopoly, not the ease of doing so. Indeed, this seems to have been the conclusion of those American policy makers, especially in Congress, who opposed aiding allies like France in acquiring nuclear weapons and opposed simply giving nuclear weapons to allies.[20] What could not be prevented could at least be subjected to substantial penalties in terms of resources and effort.

And yet, the United States did proceed to promote nuclear energy internationally and thereby help to reduce the technical barriers and material costs of acquiring a nuclear weapons option, a policy difficult to reconcile with the arms control objectives with which it was justified. In fact, the Atoms-for-Peace proposal was only in part a reflection of arms control objectives. Some of the convergent influences were completely contrary to arms control aims, others only partially or potentially so, but the internal contradictions of the Atoms-for-Peace approach were evident from the beginning.

The most contradictory element that contributed to this approach is clear in the genesis of the proposal itself within the Eisenhower Administration. In the course of the policy debate over whether or not the United States should build and deploy the H-bomb, Robert Oppenheimer argued that the U.S. public should be fully informed of the dangers of thermonuclear weapons; he and other scientists urged that strict nuclear secrecy be ended. This original appeal for "candor" in confronting the dangers of the H-bomb was transformed over a series of breakfast conferences at the White House into the Atoms-for-Peace proposal of December, 1953.[21] In part, the Atoms-for-Peace proposal helped to render politically acceptable in America and the world the government's decision to go ahead with the H-bomb.

This is not to say that Atoms-for-Peace did not have an arms control objective, with its proposal for the creation of a pool of fissile materials withdrawn from the weapons stocks of the nuclear powers. And of course, the creation of an International Atomic Energy Agency to regulate these fissile materials was a major international arms control initiative. It was the failure to achieve the first of these goals, with the consequent relegation of the IAEA to the status of a marginal technical agency, that is most frequently criticized, a failure for which American policy was partly responsible.[22]

But it is curious that even though the international political framework that would have made the Atoms-for-Peace approach a constructive arms control initiative was not realized, the international promotion of nuclear energy continued; the result was that the pace of nuclear weapons capabilities was accelerated as nations gained greater access to plutonium produced in power reactors and to weapons relevant technologies.[23] This apparent paradox was the result of the convergence in the Atoms-for-Peace proposal of an arms control rationale and domestic political interests.

It became a tenet of American policy that the spread of nuclear technology was inevitable and therefore that it was wise to seek to control that which could not be prevented. Atoms-for-Peace was designed to spread American controls internationally by means of spreading American nuclear technology and hardware. The political support generated for the proposal in America rested on the compatibility of the government's international political objectives with the nuclear industry's commercial interests.

Agreement on the "inevitability" of the spread of nuclear technology left only the timing of its spread as a relevant political consideration: convinced of the benefits of nuclear energy and the utility of its spread under American tutelage, there seemed to be no good reason not to accelerate the process.[24]

In retrospect, the assumption that the spread of nuclear technology was inevitable seems open to question. The development and spread of nuclear technology are better understood as flowing from prior political choices rather than as the result of "inexorable laws governing the flow of scientific information." The postwar priority of nuclear physics in governments' research and development allocations, the choice among various reactor types, the size, number and location of power reactors and fuel processing plants around the world are primarily the outcomes of political processes, and were promoted and subsidized by governments.

Furthermore, by accelerating the spread of nuclear energy the United States was helping to undermine its own political position. It was assumed that reliance on American-supplied nuclear energy technology and nuclear fuels would give the United States additional political leverage. But the greater the role nuclear power came to play in a nation's energy mix, the less politically tolerable continued dependence on America became. Again, this is easier to see in retrospect than it was in the mid 1950s. But the kind of hubris reflected in these earlier American policies is not altogether lacking in more recent nuclear export initiatives.

Secretary of State Dulles' version of the inevitable spread of nuclear energy was sensitive to both domestic and international politics. Before a Congress wary of international inspections, Dulles argued that nuclear plants would spread first under American promotion and controls, but that sovereign nations would not long tolerate inspection by other sovereign nations. The IAEA was essential, Dulles argued, "...if we want long-term and safe foreign markets for our nuclear materials and technology."[25]

The American concern about international exports under controls is sometimes explained as a function of American fears that the Soviet Union was poised to make a major effort in spreading its political influence through the export of civil nuclear technology.[26] While credible in the political atmosphere of the time, there is little in the record to suggest that this was in fact the Soviet intent. The Soviet Union has consistently been more reluctant to export nuclear technology and hardware than the United States, and when it has done so it has most often been to nations whose political subordination to the Soviet Union acted as a control on the uses to which the technology would be put.[27]

British, not Soviet, nuclear exports seem to have been the dominant preoccupation of American policymakers. The British nuclear energy program commanded relatively impressive resources in the immediate postwar period. With more pressing energy needs than the United States, Great Britain specialized earlier and gained initial successes with its natural uranium fueled reactor type.[28] By 1952-3 the British seemed a step ahead of the American nuclear industry--and were aggressively seeking commercial outlets overseas. American industry opposed the policy of nuclear secrecy as the major obstacle to commercial nuclear power in the United States, and as an impediment to meeting foreign competition. This was the commercial challenge to which the Atoms-for-Peace proposal was designed to respond.

By the mid 1950s the lag in nuclear power installation in America threatened the nuclear industry with an excess in productive capacity while the potential overseas market was estimated at $30 billion.[29] Electricity produced by conventional fuels was too cheap in America for nuclear power to compete economically, but overseas, especially in

Western Europe, the costs of conventional fuels were higher and fuel supplies were largely imported. Thus, Americans looked to foreign markets to bolster a flagging domestic nuclear industry. And the American government, with its own enormous investment in nuclear energy, was prepared to actively promote the commercialization abroad of nuclear energy. Under the Atoms-for-Peace program, bilateral agreements were concluded with forty-three nations between 1955 and 1958, involving the transfer of research and power reactors subsidized by the United States government, in addition to exchanges of technology and personnel.[30] All of this required the revision of American statutes regarding nuclear energy which were progressively liberalized, especially in 1954 and 1958, to permit and encourage the commercialization and internationalization of nuclear energy.[31] While these bilateral agreements fell short of the exaggerated expectations of the American nuclear industry, they did succeed in stimulating foreign interest in nuclear energy despite the lag in American nuclear power installation.

Where the most obvious tensions arose between the policies of international commercial promotion and arms control, the tension was dissipated in favor of commercial promotion. Thus when the Euratom countries refused both direct American inspection and international inspection under the IAEA, the United States allowed them the right of self inspection.[32] This was a politically important concession that rendered the IAEA inspection system stillborn but opened an attractive international market to the American nuclear industry.[33]

In practice, the prevalence of American technology on the international nuclear market did have positive implications for arms control: American enriched uranium fueled reactors produce only about one-half the plutonium that natural uranium reactor types do; American pressure vessel reactors can only be refueled with costly and obvious reactor shut-downs, making it difficult to hide any diversion of fissile materials from the fuel elements; American reactors have been dependent on the AEC for fuels and are subject therefore to periodic inspection. All of these are positive contributions to nuclear arms control and may have had some effect on the choice of reactor types by various nations in the spate of power reactor orders of the late 1950s and early 1960s. Those governments and utilities interested in long-term independence in nuclear technology may have favored British natural uraniums fueled reactor types,[34] but the American government's willingness to offset the disadvantages of dependence with attractive financial packages seems to have been crucial in winning several of the early international competitions.[35]

Finally, there is little evidence to suggest that these arms control implications played any major role in the American selection of reactor types to pursue commercially. The successful light water reactor was a spinoff from the submarine reactor program. Alternatives were eliminated as a result of technical and economic criteria. Like the British, American industries simply exported what they had to sell.[36]

Arms control and commercial promotion, at best convergent interests but never really the logical ends and means of a coherent policy, have grown increasingly incompatible. Despite the failure of nuclear power to emerge as economically competitive without government subsidies until the late 1960s,[37] an international nuclear industry was established. This industry is generally composed of the nuclear power divisions of huge electronics companies, many of which operate as subsidiaries or licensees of multinational corporations based in the United States.[38] In the major industrial countries, the predominance of licensing is a result of the political preference of governments for the highest possible degree of national independence in nuclear technology; licensing of a national company seems politically preferable to direct foreign investment. There is considerable competition to export to countries without established nuclear industries not only among American firms, but between them and former licensees (e.g. German competition for reactor orders in Argentina and Brazil), or even with firms that are presently licensees (e.g. French competition for Iranian reactor orders). There is also competition between different lines of reactor technology (e.g. the American enriched uranium fueled reactor versus the Canadian natural uranium fueled reactor). A kind of global division of labor may be emerging in which, for example, Japanese licensees of American multinationals might compete for smaller sized reactor exports to Southeast Asia while leaving the larger reactors to American firms.

This emerging pattern of competition is symbolic of broader political changes that are transforming the American-dominated postwar international system. Nuclear energy is politically attractive for advanced industrial countries because of the independence from energy imports it affords. Nations which must import their nuclear power plants and fuels see this as a way of increasing national independence through diversifying energy sources. As international competition in the nuclear industry intensifies, it reduces the prospect for exercising political influence through nuclear exports. Despite the "interdependence" of the industrialized nations, there is little evidence of a perception of common interest that could make nuclear exporters into a cartel with the political influence of OPEC.

But these industrial competitors have at least one thing in common: they have an interest in the pursuit of their economic activities with a minimum of political restrictions. This interest is shared in part with their national governments: restrictions that reduce the international competiveness of a nation's nuclear industry diminish the prospects for significant foreign trade agreements, and perhaps reduce the industry's ability to meet pressing domestic energy needs as well. The political pressures exerted by this kind of constellation of government and private interests have been important and will become increasingly so in the future. The question is whether arms control objectives, already eroded, will become completely submerged in the future by commercial objectives.

THE COMMERCIALIZATION OF NUCLEAR POWER AND THE NPT

International commercial competition has always been an obstacle to attempts to control conventional armaments. But it was not until the NPT negotiations that nuclear arms control measures confronted commercial calculations openly and directly. And it was in relation to the NPT that the corrosive effects of the commercialization of nuclear energy on the prospects for nuclear arms control became most evident.

As originally tabled in 1967, the joint Soviet-American draft NPT emphasized the restrictions to be placed on the Non-Nuclear Weapons States (NNWSs) and down-played the obligations of the Nuclear Weapons States (NWSs). Even as revised, the Treaty remains an unequal one in which obligations and responsibilities are clearly unbalanced. To some extent, this imbalance mirrors the present international system in which power is differentially distributed. But many governments saw the Treaty as an attempt to legitimize and perpetuate these international disparities: these governments needed no additional reason to reject the NPT.

Other NNWS governments were willing to overlook the political inequalities of the Treaty because of their support for the arms control objective that the Treaty embodied, but even some of these had reason to object to the commercial effects of the NPT which were so clearly discriminatory as to add economic injury to political insult. It was argued that the inspection of the nuclear industries of the NNWSs would put them at a competitive disadvantage vis-a-vis the NWSs and non-parties to the Treaty. The fear was voiced that industrial espionage would be facilitated by opening domestic industries to IAEA inspectors, especially where such inspectors might be citizens of countries with which there were long-standing political differences. There were complaints that the Treaty would have the effect of restricting the international exchange of nuclear technology and information with the result of retarding the nuclear progress of the NNWSs.

While the United States had consistently hailed the economic advantages of nuclear energy, the American-backed NPT seemed particularly insensitive to the commercial aspects of nuclear technology. Understandably, there was some suspicion that the superpowers were pursuing their economic advantages in the guise of nuclear arms control, and consequently many nations demanded revisions of the draft Treaty to mitigate its most serious economic defects.[39]

In the NWSs, there was a tendency to reject these kinds of objections as masking a desire on the part of certain nations to preserve nuclear weapons options. The vigor with which some of these arguments were voiced by nations like India and Brazil whose nuclear industries have only marginal roles in the world market made these arguments suspect--all the more so when they were linked to advocacy of the right to peaceful nuclear explosives (PNEs).[40] But these arguments were also made by nations like West Germany, Italy, and Japan and were perfectly consonant with their national economic concerns. Their adoption of these arguments was ultimately most persuasive in convincing the United States and the Soviet Union to give additional emphasis to Artivle IV's exhortation to promote the international exchange of civil nuclear technology.

The demands of the NNWSs went far beyond this kind of generic commitment on the part of the NWSs. A relevant example is the set of proposals advanced by the Italian government in August 1967, which was influential in the elaboration of recommendations by the Conference of NNWSs in 1968.[41] The thrust of these proposals was to give the NNWSs signatories to the NPT concrete economic and technical rewards for accession to the Treaty: they sought to commit explicitly the NWSs to transfer civil nuclear technology to the NNWSs and in particular to guarantee enriched uranium fuel supplies to NNWSs at less than market cost.[42] These proposals were in line with the aims of the original Atoms-for-Peace proposal which would have furthered disarmament by creating a pool of fissile fuels taken from nuclear weapons stocks, and would have gone a long way towards redressing the imbalance of obligations under the NPT. The political inequalities would have remained, but the unacceptability of these inequalities would have been mitigated by the concrete benefits derived from participation in the Treaty.

The NWSs rejected all of the more specific commitments but the American government was not completely unresponsive to the demands of teh NNWSs. President Johnson offered to place all of America's nuclear industry under IAEA inspection except for any part explicity related to national security,[43] an offer echoed by Great Britain but not by the Soviet Union. This gesture reduced the force of the argument that the United States was seeking to maintain its commercial advantage at the expense of competitors. However, since inspections were conditional on the entering into full force of the IAEA inspection system elsewhere, they have yet to be applied to American industry. The nation for which such inspections are presumably the least objectionable, the United States, will be the last to be inspected rather than the first.[44]

The NNWSs' refusal to assume the burden of producing and supplying nuclear fuels for NNWSs is particularly interesting and important. The AEC has had a monopoly on the non-communist world's upply of commercial enriched uranium and has consciously manipulated this monopoly as a tool of American nonproliferation policy. Thus, the United States successfully blocked efforts on the part of Euratom countries to build on enrichment plant in 1957-58 by manipulating terms and prices of American-supplied uranium.[45] Maintaining a fuel monopoly under the aegis of the NPT would have been a logical extension of this policy.

But the commercialization of nuclear power, dominated by the American LWR, resulted in enormous increases in projected demands for enrichment services. For the NWSs to assume the obligation to provide fuel services for all the NNWSs signatories to the Treaty could have quickly amounted to a commitment of several billion dollars per year on the part of the AEC requiring greatly expanded plant capacity; and of course, the AEC would be under strong political pressure not to charge commercial rates for these obligations assumed under international treaty--just as the NWSs are obligated to provide PNEs at less than market cost under the NPT's Article V. The United States government was understandably reluctant to undertake this kind of responsibility. These projected increases in demand led American and foreign industrial interests to eye the uranium enrichment field as an attractive commercial proposition. The prospective commercialization of this last area of government nuclear monopoly made it an unlikely area for international commitments on a noncommercial basis.

This kind of economic consideration precluded any American government use of its enrichment monopoly as a tool of its arms control policy: the means adopted for spreading American controls, the commercialization of nuclear energy based on American fuel supplies, began to envelop the goal of arms control. The commitment of Article IV to the "fullest possible exchange" of nuclear energy technology implies an obligation to share nuclear technology.[46] But in practice, market forces are increasingly the only mechanism for international nuclear technology transfers.[47] The possible economic costs of Treaty adherence were easy to imagine; the economic benefits were hard to discern. The result was to weaken the appeal of the NPT to those nations which might have been susceptible to economic inducements. Even where these nations signed and eventually ratified the Treaty, it was with the kind of profound political reservations which undermine the Treaty's broader goals.[48]

POLITICAL CONTROLS AND ENRICHED URANIUM

The long-term impact of the NPT on proliferation has yet to be seen. But one short-term impact has been to help to reduce obstacles to the spread of weapons relevant technologies, particularly in the nuclear fuel sector. The acceptance of IAEA safeguards by NNWSs makes it politically difficult for NWS parties to the Treaty to resist demands for purchases of fuel processing and enrichment technologies.[49] Interest in these technologies has grown as the debate on the Treaty sensitized many nations to the importance of nuclear technology to national independence and economic well-being at the same time that it called into question established patterns of dependence, particularly on the United States, for supplies of enriched uranium for power reactor fuels.[50]

By the end of the 1960s, the goal of providing commercially viable nuclear power was essentially achieved: nuclear power was marginally economical in many nations and promised to be even more economical in the future. One of the consequences of this was the tendency for American nuclear energy policy to lose its relative coherence; the generalized support from disparate groups seemed to crumble. The scientific community began to split over the wisdom of nuclear power as environmental and safety concerns grew. The AEC vascillated between promoting the nuclear industry and promoting its institutional interests through increased vigilance in its regulatory functions. The JCAE was increasingly ambivalent about the proper degree of government participation in nuclear industrial undertakings while industrial circles grew restive under government controls now that government promotional activities seemed less essential. This loss of policy coherence was to have important arms control implications, especially in the field of uranium enrichment.

The American international inspections system depended on American dominance of the uranium enrichment sector: the right to inspection has not been tied to the nuclear reactor but to the fissile fuels supplied to run the reactor. Anticipating a huge market at home and abroad, in the late 1960s the American industrial interests began to press the government to allow a private takeover of the $2.3 billion gaseous diffusion enrichment plants that the AEC had operated as a government monopoly since the end of World War II.[51] The advent of the Nixon administration provided a sympathetic political context in Washington, and it became established administration policy to move towards the "privatization" of the enrichment facilities.[52] Under increasing public pressure, the AEC seemed inclined to exercise more regulatory controls over the industry under which the nuclear industry increasingly chafed; but the future of the AEC itself was in question and it tended to be relatively acquiescent on the question of the future of the enrichment facilities, prepared to entertain a number of possibilities.[53] The most open opposition came from members of the JCAE, some of whom seemed reluctant to see the government lose a monopoly and others who feared that privatization would result in higher enrichment charges and reduced economic viability of nuclear energy.[54] The result was a period of uncertainty in American enrichment policy in which foreign customers of the AEC could not be sure of the ability or willingness of the government to continue to supply their fuel needs. Two successive price rises with the promise of more to come made the search for alternatives to continued dependence on the United States all the more attractive.[55] The Nixon Administration's responsiveness to domestic political interests was matched by its indifference to the international consequences of its acts.

American policy changes coincided with a technological breakthrough in Western Europe that provided a possible alternative to continued dependence on the United States for enriched uranium supplies. In 1970, after a lengthy process of negotiations, the British, Dutch and West Germans signed an intergovernmental agreement to establish a consortium for the production of enriched uranium on a commercial basis in competition with the United States.[56] The technology used in this process has important proliferation implications: consuming much less electricity than the gaseous diffusion process, centrifuge separation will be economical on virtually any plant scale and could be concealed in a modest-sized laboratory. In the early 1960s the American government was sufficiently concerned about the implications of this technology to persuade the British and German governments to classify their centrifuge research, and to halt private American research on this technology by 1967.[57] But when the tripartite consortium was announced, the American nuclear industry began to pressure the government to give them access to classified research on the centrifuge and on gaseous diffusion--and argued that the failure to do so would put them at a competitive disadvantage vis-à-vis their European counterparts.[58] The government responded with the Domestic Access Program through which American industries have launched research and development efforts aimed at possible future commercial enrichment ventures.[59]

The tripartitie consortium was not the only international alternative to American enriched uranium to emerge in the years since the NPT came into force. The French relaunched their effort to get European backing for a commercial scale gaseous diffusion plant based on French technology; a French Commissariat à l'Energie Atomique policy goal from the mid-1950s, such a plant had become a national imperative after the 1969 decision by President Pompidou to abandon the French national natural uranium fueled reactor.[60] The Commission of the EEC favored this kind of project as a means of reviving Euratom.[61] And France sought to open its Eurodif Association to non-governmental interests in hope of luring support from the private sector in West Germany and Britain where the governments were already committed to the rival centrifuge process.[62] But in the end, France was forced to go ahead with the financial backing of Italy, Belgium, Spain, and at the last moment, Iran.[63]

The evolution of the French gaseous diffusion project from a venture under the sponsorship of the European communities to one including Spain and Iran is symbolic of the corrosion of established political ties through international commercial competition in nuclear energy. Intense nationalism had already deprived Euratom of its integrative impact. As one more step in this process, the French gaseous diffusion project passed from a context of maximum potential international political commitments (and therefore, also maximum potential mutual constraints) and became merely another international economic arrangement with minimal political commitments (and therefore, minimal political constraints).

France has also entertained proposals for exporting enrichment plants to Canada and Australia.[64] The tripartite consortium has likewise speculated on future exports of centrifuge plants. In order to head off the development of overseas competition, since 1971 the American government has offered to share enrichment technology with friendly countries.[65] The Soviet Union, South Africa and other nations are entering the commercial enrichment field.[66] Uranium enrichment facilities are clearly becoming an international commercial commodity, and technological innovations like laser isotope separation will become a part of this intense international competition. These trends promise not only to remove any technical barriers to the proliferation of nuclear weapons capabilities but actually to encourage appetites for acquisition of such capabilities.

This kind of commercial competition among industrial countries has undermined arms control policies. For example, in 1973 and 1974 the United States intensified its efforts to convince the Japanese government to ratify the NPT as part of its larger political objectives in Asia. One of the arguments used by American spokesmen was that it might be impossible for the United States to continue to supply the Japanese nuclear industry with enriched uranium fuels if the Japanese government failed to ratify the NPT.[67] But since the terms for American enriched uranium supplies were being stiffened and the future reliability of American commitments was open to question, the Japanese were already seeking alternative sources of supply, especially for the longer term.[68] At this point the Soviet Union approached the Japanese with an offer to provide enrichment services on terms that were commercially very competitive with those of the United States; but the Soviet Union apparently also demanded prior NPT ratification by Japan.[69] The French had also approached the Japanese government to gain Japanese financing of a French designed plant to be built in Australia.[70] Meanwhile, Japanese utilities became major customers of the French-backed Eurodif Association[71] without Japan having to meet any political preconditions like NPT ratification.

The loss of the American monopoly on the commercial supplies of enriched uranium has eliminated the principal American lever in influencing other nations' nuclear energy policies. This American policy was finally discredited completely in the summer of 1974 when President Nixon offered nuclear reactors and fuels to Egypt and Israel apparently without any demand that they first ratify the NPT.[72] This offer was an affront to the Japanese and others who were being asked to assume more stringent kinds of commitments, and was an initiative that seemed to negate any advantages to be gained by adherence to the NPT by rewarding those who chose to reject the Treaty.

The congress was sufficiently concerned about the proliferation implications of reactor and fuel exports to the Middle East to reserve the final approval of any such transfers. In the preceding months, Secretary Kissenger had repeatedly offered to share uranium enrichment technology with other industrial nations as an inducement for cooperation in dealing with the oil crisis: the reactor offers to the Middle East may have been part of this broader policy. Administration spokesmen defended those proposed exports with arguments grounded in the conviction that nuclear technology is still a useful means of extending American political and economic influence. It was argued that 1) if we do not do it someone else will--someone less interested in exercising bilateral controls to prevent the abuse of this technology and hardware; that 2) this will increase the political dependence of these nations on America and therefore allow the United States to influence the uses to which the technology may be put; and that 3) such exports are good for business.[73] These same kinds of arguments are often used to justify conventional arms sales to volatile areas.

The first point is probably true, and this is the heart of the problem. International commercial competition has a propulsive effect, accelerating the pace of acquisition of nuclear weapons capabilities and reducing the kind of political restraints that can be exercised. It is not clear whether the initiative for nuclear reactors came from the Egyptians or potential suppliers, nor it is clear how nuclear power fits into Egyptian economic development plans. It does seem clear that the "someone else" in question is more likely France than the Soviet Union, although the latter may step in the wake of the initial check on the American offers.[74] Competition among political allies like the United States, France, West Germany, and Canada in the nuclear field resembles more and more the competition in conventional armaments exports, with even more potentially disastrous effects on international stability. This kind of competition suggests that if nonproliferation objectives are to be met, the agreement of all states capable of exporting nuclear capabilities must be obtained; the United States might be advised to spend less time negotiating with countries like France.

As to the second point, the use of nuclear technology to make others politically dependent on the United States seems increasingly chimerical. Under the best of circumstances, the successful exercise of control over other nations' undesirable nuclear programs--as opposed to the successful promotion of nuclear energy--has been dependent upon a broad pattern of political interdependence, an effective American monopoly of a relevant technology, and the American government's willingness to use that monopoly for political purposes.[75]

The third rationale seems to be a more potent explanation for these proposed exports, and one that is relevant for other nuclear exporters' policies as well. With serious balance of payments problems, the United States naturally looks to its advanced technologies as a source of overseas earnings. International competition for such exports is likely to make governments less particular about the long-term political implications of their actions and more included to exaggerate the short-term political benefits. Industries are eager to compete for purely economic reasons. But the arms control consequences of these policies continue to grow in importance. International competition in reactors, enrichment facilities and fuel reprocessing plants is only one step short of the point where a nation like France sells nuclear weapons on the open market.[76]

The prospects for the successful exercise of political restraint through nuclear exports are dim at best. Only two things seem relatively certain: that the United States has an economic interest in nuclear exports, and that these exports will increase the nuclear weapons capabilities of countries like Egypt and Israel.

PROLIFERATION AND DOMESTIC POLITICS

The Indian detonation raises the problem of the mix of domestic and foreign policy calculations in a decision to go nuclear. Because of the international impact of the Indian explosion, it is assumed that the decision to demonstrate a PNE was the result of international political calculations of the highest kind. And yet, there are reasons to believe that more mundane domestic political considerations may have been almost as important; one is tempted to say that the test was allowed to take place in spite of its international implications.[77] What is important is that possession of a nuclear capability can become a dynamic element in the decision-making process, influencing estimations of the incentives and disincentives of going nuclear.

Arms control analyses tend to focus on the international milieu as the prime policy determinant, and antiproliferation policies usually aim at achieving international conditions that would logically decrease incentives to go nuclear. This approach has two kinds of inherent problems: the superpowers' consensus on a stable nuclear deterrent as an arms control objective in practice re-enforces some other nations' incentives to go nuclear; and to the extent that a decision to go nuclear may reflect domestic political conditions, nonproliferation strategies focusing on the international milieu may be only marginally relevant or even counterproductive.

Japan is a case in point. An examination of Japan's exposed position, a neighbor of two nuclear powers in an area where others may emerge, suggests that Japan may seriously consider a nuclear option. Only Soviet and Chinese nuclear disarmament could remove these Japanese strategic concerns. Japan has a nuclear weapons capability based in part on nuclear energy technology imported from the United States. Therefore it is argued that the credibility of American nuclear deterrent commitment to Japan must be maintained lest the Japanese go nuclear. But in fact, domestic political opposition to a nuclear option is strong in Japan among those who are most opposed to reliance on the United States for its nuclear deterrent--the left opposition parties, the scientific community, and public opinion in general. This domestic opposition constitutes the major restraint on those few in Japan who would like to have nuclear weapons. American policies favoring a Japanese conventional military build-up and emphasis on a nuclear deterrent through the Security Treaty are rationalized in part because of their antiproliferation effects. But these policies find most support in Japan among the only political elements that favor nuclear weapons--among some of the military and right-wing factions of the ruling Liberal Democratic Party.[78] In effect, American policies tend to favor those Japanese who are least committed to the goal of nonproliferation.

The application of the general principles of nonproliferation to particular domestic political situations may have equivocal effects.

The domestic political determinants of a nuclear option are inherently more difficult to influence from the outside than the international determinants. American arms control policies have been justified in part as designed to give the United States leverage over the domestic development of nuclear energy in other nations by making them dependent on it for nuclear technology and fuels. But in practice, the United States has been most successful in promoting nuclear energy. The American development of atomic energy establishments in dozens of nations has helped to raise the international level of sophistication in nuclear technology to the point where there are alternatives to dependence on the United States. The existence of these alternatives makes sanctions like nuclear fuel cut-offs a high cost option in political and economic terms with little prospect of long term success.[79] Without this kind of leverage, nuclear exports become an economic exchange like any other.

International commercial competition is part of a broader process through which the political bases for the successful exercise of American influence have been eroded. This erosion and the general trend toward diversity in the international system are crucial because the relevance of expedients like safeguards to the problem of nuclear proliferation depends on the political milieu in which they operate. Safeguards are only as effective as the political bonds that link the members of the international system. Even in the immediate postwar period, French dependence upon and confidence in the United States were not sufficient to prevent the French from persisting in a nuclear weapons program despite strong American opposition. The improvement of national technical capabilities was a principal means of asserting French independence.[80] In the future nations whose political perceptions and interests are as different from America's as Egypt's, Israel's, and Iran's will be even less restrained by American political pressures than France was in the past, and will use their technical capabilities to pursue their independent interests.

But whereas American policy in the past made the French nuclear option a costly policy choice, present American policy in effect reduces the costs and difficulty of acquiring a nuclear option, exporting on near commercial terms not only weapons-relevant nuclear technology but advanced delivery systems as well. These policies should be reevaluated.

From the beginning the "nuclear dilemma" has been that the peaceful uses of nuclear technology cannot be promoted without promoting nuclear weapons potential. One must be convinced of the overwhelming advantages of the former in order to run the risks of the latter. Since the international political conditions that would render benign the spread of nuclear technology have failed to materialize, it is necessary to reassess the desirability of nuclear energy from an arms control perspective.

Here there is a convergence between arms control advocates and those at the domestic level who have attacked nuclear energy because of their concerns for public health and safety, and environmental degradation. Analysts who in the past have been concerned with the problem of devising adequate safeguards to detect the diversion of fissile materials by governments from nuclear plants to weapons purposes have now turned their attention to the necessity of devising security measures to prevent the diversion of fissile materials from the nuclear industry by criminals or political dissidents.[81] The opportunities for such mischief, with international ramifications, will grow as the commercialization of nuclear energy continues, especially when and if plutonium becomes a major fuel in the nuclear industry.[82] The need for adequate nuclear security measures must be added to the need for protection against risks to public health and safety, uncertainties regarding nuclear plant performance, the threat of environmental degradation, and the unresolved problems of waste disposal, further reducing the public acceptability and economic competitivity of nuclear energy.[83]

ENERGY POLICY AND NONPROLIFERATION ALTERNATIVES

Up to now, governments have persistently exaggerated the promise of nuclear energy and down-played its negative potential. The energy crisis has made nuclear power more attractive than ever before, and resulted in projected increases in future dependence on nuclear power. But there are alternatives to these policies that would have both profound domestic economic and political implications as well as a direct bearing on nuclear proliferation prospects. There are indications of interest in some of these measures in Congress.[84] Alternatives range from the most general reassessment of the viability of heavy dependence on nuclear energy in meeting future energy requirements, to more modest attempts to shape the development of nuclear power in ways more consistent with arms control objectives, to limited attempts to monitor the development of independent nuclear weapons capabilities abroad. These latter, more limited kinds of measures are those that depart least from established policies and therefore least threaten established interests; they have attracted the most attention from arms control advocates and have the best chance of being enacted in some part.

The political commitment to greater independence from imported energy sources, the existence of domestic political and economic interests in favor of commercial nuclear energy, and an increasingly competitive international system make it unlikely that more restrictive policies in nuclear energy will be enacted. Only a convergence of domestic political opposition to nuclear energy and the according of a higher priority to the threat of nuclear proliferation could offset the impact of problems like the energy crisis. At present, such a convergence seems unlikely. But in considering broader, if less likely, kinds of alternatives, the definition of that which is possible may be widened.

1) The measures with the most comprehensive effects in terms of limiting nuclear proliferation are those that would retard the international increase in dependence on nuclear energy. These measures would help impede the growth of bureaucratic and economic interests which form the necessary infrastructure for a nuclear capability and which might serve as a basis of political support for a nuclear weapons option. But most important these steps would make acquiring a nuclear option most costly and obvious. The economic obstacles could be crucial, particularly where investment in national fuel processing and enrichment plants is concerned. In an inversion of the logic that has prevailed up to now in NWSs, in the future a nuclear energy program may be necessary to justify the costs of a nuclear weapons option.[85]

As an alternative to increased dependence on OPEC, nuclear energy represents a kind of "technological fix" for an essentially political problem. But the economic viability of nuclear energy is open to question. It is only with the enormous increases in the price of oil in the last year that nuclear power clearly became economically competitive, and those oil prices must remain high to maintain the competitiveness of nuclear power. But ironically, the oil crisis has also helped to reduce the attractiveness of nuclear energy by making it increasingly difficult to finance. In America and elsewhere the relatively lower operating costs of nuclear plants is accompanied by higher initial capital investment,[86] and high interest rates have made nuclear power prohibitively expensive to finance. Sixty percent of the nuclear power plants on order or planned have been cancelled in America in the last several months.[87] Economically hard-pressed countries like Britain, Italy, and France are also finding it difficult to finance their projected increased dependence on nuclear power.[88]

The United States has embarked on a limited sort of nuclear moratorium and other nations may be compelled to do likewise. Without massive government intervention, the American nuclear industry is headed for a marked decline. Simply as an arms control measure, it might be opportune to make a political virtue out of economic necessity and proclaim a nuclear moratorium, including the suspension of the export of nuclear reactors and fuel reprocessing technologies.[89]

While each nation has its own distinctive energy problems, this kind of example could help to reduce the image of the "inevitability" of high rates of dependence on nuclear power. Sweden has already set an example in this respect, reducing not only projected growth in energy consumption as well.[90] A moratorium might also help reduce the competetive export drive in politically sensitive nuclear hardware. Without government help, the American nuclear industry would find it difficult to compete on the international market and other governments might be less inclined to promote the exports of their own hard pressed nuclear industries. But most importantly, this kind of measure would provide a political basis for more restrictive policies in exporting nuclear technology. Unlike its policies regarding nuclear weapons, the United States would be setting the example for the conduct it wants other nations to follow.

The American government is currently under pressure to come to the aid of the domestic nuclear energy industry; the Kissinger proposal to artifically maintain the high price of oil is calculated in part to make investment in alternative energy sources like nuclear power economically viable. The government is also under pressure to give more direct support to the power industry to help finance nuclear installations; without such support, utilities will be unable to meet the goals the President has set for installed nuclear capacity by the year 1985.[91] Should either of these two policies fail to win congressional approval, there could be a positive arms control impact. An optimal solution would discriminate against nuclear power while encouraging the development of alternative energy technologies.

2) A second range of alternatives involves the shaping of the increased dependence on nuclear energy in ways more compatible with arms control objectives. Here, two different courses might be followed. One course, outlined above, would be to reduce government support for nuclear energy and

thereby reduce its economic competitiveness; this would limit future increases in dependence on nuclear power. The other would be to de-commercialize nuclear energy by direct government takeover of the nuclear industry and the subjection of nuclear energy to rigid nonproliferation criteria. Government takeover alone is no panacea; government participation and government regulation of the nuclear industry is high everywhere and has almost universally resulted in government promotion. Government control and government commitment are needed to limit the degree of future dependence on nuclear energy and to more carefully restrict the export of nuclear reactors, fuels, and related technologies.

Domestic measures of this kind include resisting the pressure to recycle plutonium in power reactors and refusing to accelerate the commercialization of the plutonium-fueled fast breeder reactor.[92] In terms of fuel supplies, the ideal would be to maintain the role of governments as the sources of enriched uranium through terms and prices that are low enough to discourage private competition while being high enough to discourage heavy dependence on nuclear energy.

International analogues of these measures would be a refusal to fabricate plutonium fuels for other nations and perhaps reversion to the policy of buying back plutonium produced in American-supplied reactors. The "internationalization" of enrichment plants and reprocessing facilities would also help limit proliferation. These kinds of proposals seem more likely if governments dominate the fuel cycle than if private economic interests do so.

International cooperation might take the form of a cartel of nuclear exporting nations. This would limit competition among these nations on the basis of a political consensus to seek to limit proliferation. For example, a cartel might prohibit the exports of enrichment technology and fuel reprocessing plants and in return furnish fuels supplies on a secure, long-term basis. Informal agreements among nuclear exporters might achieve the same general aim with fewer negative political problems vis-a-vis clients, but without a formal cartel, it would be difficult to maintain the integrity of the agreement over time.

The principal obstacle here is, of course, the lack of clear political commitment to the priority of nonproliferation which is a prerequisite to the success of these kinds of policies. As energy and international economic problems have grown in importance, nonproliferation has receded as a concern of policy makers. But solutions to energy and economic problems that run counter to the objective of nonproliferation will be very short-sighted. The energy crisis is a part of a more general emerging "new international economic order" based on demands for a "global redistribution of wealth." The inevitable conflicts attending these international adjustments can only be more difficult to cope with when they are accompanied by further nuclear proliferation.

Without an overarching political commitment to nonproliferation, sub-governmental units often work at cross purposes. Here there is a convergence between arms control advocates and those who seek to exert more effective political controls on bureaucratic actors. In the United States, the division of the functions of the AEC into two government agencies may serve to reduce the influence of proponents of nuclear energy in the government and strengthen political controls, with positive collateral effects on nonproliferation.

The assertion of tighter government controls over the international nuclear industry would at a certain point have to face the problem of multinational corporations. Nuclear technology transfers by firms like General Electric and Westinghouse may not always be subject to government review, especially as commercialization proceeds. Government and private industry have differed in their perceptions of the demands of national security in the past,[93] and may be expected to do so more frequently in the future. Here there is a convergence of interests between arms control objectives and the attempts at the national level, in the UN, and in bodies like the EEC and OECD to regulate the activities of multinational corporations.

The emphasis here is on the control of nuclear hardware rather than scientific information, but the fundamental objections to these kinds of controls go back to the roots of the debate over nuclear secrecy. The argument that it is impractical to seek to restrict information is truer today than in the immediate postwar period. The aim of a more restrictive policy cannot be to prevent a nation from going nuclear; the information necessary to do so has long been available publicly. The more modest aim is twofold: to increase the difficulty and, in particular, the costs of acquiring a nuclear weapons option independently; and to reduce the responsibility of America and other nuclear technology exporters in the process by which other nations move towards a nuclear weapons capability. Whether such modest aims are justified by the political and economic costs of a more restrictive policy is open to question.

But in the determination of the wider costs and benefits of such a policy, another argument made against the restriction of scientific information must be weighed: it is argued that the restriction of scientific information, and by implication the restriction of private economic activity, is wrong in principle, inimical to a free society and to technological progress. These considerations must be weighed against the threat to freedom implicit in the proliferation of nuclear weapons and of the compromises of freedom manifest in nuclear safeguards and security measures. The costs of present policies may ultimately exceed the present costs of alternatives.

3) Attention to international inspections has intensified as the 1975 NPT Review Conference has neared. Safeguard inspection agreements like those negotiated under the NPT must

be considered as one of the more limited kinds of anti-proliferation measures.[94] Inspection by the IAEA is designed to detect diversion, not to prevent it.[95] But the threat of early detection acts as a deterrent to the diversion of fissile materials to weapons programs. Safeguards are political expedients, not technical solutions to the problem of nuclear proliferation. The commitment assumed by adherence to the NPT and submission to international inspection is a political constraint and can, therefore, make a contribution to nonproliferation. But the principal danger of safeguards is that they might become an end in themselves instead of a step towards an evolving, cooperative international system in which nuclear weapons are less relevant.

The institution of an international safeguards inspection system may indicate a more cooperative, integrative kind of international system. But present demands for more stringent safeguards, coupled with pressure for uniform international nuclear security measures, suggest a rather less optimistic set of expectations. More restrictive measures on the export of nuclear technology are also suggestive of a fundamental pessimism. But it seems unlikely that such measures would have any effect but to confirm already established trends, and would not in themselves cause a negative evolution of the international system.

Over time it seeks likely that safeguards procedures may provide an unacceptable degree of technical assurance. This will in part reflect the size of the operations being monitored: even materials accounting systems which are 99 percent effective, applied to processes through which pass tons of enriched uranium or plutonium, will have a percentage of materials-unaccounted-for (MUF) amounting to dozens of warhead equivalents.[96] While such accounting procedures could become more precise with technical improvements, the increments in precision are likely to be gained only with disproportionate increases in the costs of the operations. In other words, in the future, safeguards may be less effective, or more costly and more intrusive--and conceivably, all three. In a commercially competitive situation, a difference of even a few percent of the total cost of production can mean the difference between economic viability and non-viability. The temptation for governments and industries to cut corners, unrelated to any intent to deviate materials for weapons purposes, will be very strong. Once the integrity of the safeguards system is compromised, the possibilities for deviation of various kinds will increase enormously.

But more importantly, in a world in which the incentive to go nuclear is far from lacking, future nuclear weapons forces are likely to arise either from the unilateral denunciation of the NPT by a nation undetected in any improper deviation, or by a nation not party to the Treaty. This is not a problem for safeguards: it is a broader kind of political problem. The dominant trends in international politics are such that the political will and technical capability of the nuclear exporters are less effective as restraints, while in countries that import nuclear technology, the political power and technical competence of those groups which might favor a future nuclear option are growing. Under these circumstances, safeguards may simply serve to facilitate and hasten the creation of nuclear weapons options in a score of additional nations.[97]

There are no absolute barriers to acquiring a nuclear weapons force, but there are relative obstacles. There is a range of policy alternatives that could slow the pace of the evolution of nuclear capabilities, particularly in those countries which have yet to achieve a completely independent civil nuclear energy program. Whether the time gained by adopting these alternatives would be wisely used depends on an even wider range of considerations. Current trends favor the subordination of nonproliferation concerns to international economic calculations and domestic political considerations. But the ways in which the choices of advanced industrial countries in international economic and national energy policies affect arms control prospects should still be borne in mind. While it may be tempting to hope that the institution of an international inspection system under the NPT marks the beginning of a positive new era in international politics, there are also reasons to fear that the problems of the nuclear age have really only just begun.

Footnotes

1. See for example Victor Gilinsky, "Military Potential of Civilian Nuclear Power," in Bennett Boskey and Mason Willrich, eds., Nuclear Proliferation: Prospects for Control (New York: The Dunellen Co., 1970).

2. The difference between the Indian nuclear program and the French program may be one of degree rather than kind. But it does seem that France moved much more directly towards a nuclear explosion than India did. For example, only two years elapsed between France's completion of its plutonium extraction capability and its first nuclear explosion. In the Indian case, ten years separate these two steps--years that were devoted to developing a wide range of programs not strictly related to a military option.

3. B. M. Jasani, "Nuclear Fabrication Plants," in SIPRI, Nuclear Proliferation Problems (Stockholm, 1974), Tables 11.a, 11.b.

4. B. M. Jasani, "Nuclear Fuel Reprocessing Plants," ibid., Table 4. Besides the nuclear weapons states, they are Argentina, Belgium, Czechoslovakia, West Germany, India, Italy, Japan and Spain.

5. See the OECD projections of 50 percent dependence on nuclear generated electricity by 2000 in Nuclear Industry, January 1975; and Geoffrey Greenhalgh, "World Nuclear Programmes," Nuclear Industry International, Vol. 20, No. 226 (March 1975), pp. 164-71.

6. James A. Lane, "The Impact of Oil Price Increases on the Market for Nuclear Power in Developing Countries," Bulletin of the International Atomic Energy Agency, Vol. 16, No. 1/2 (1974), pp. 66-71.

7. Denis M. Slavich and Charles W. Snyder, "Meeting the Financial Needs of the Nuclear Power Industry," Nuclear Engineering International, Vol. 20, No. 226 (March 1975), pp. 161-63.

8. Bertrand Goldschmidt, "International Nuclear Collaboration and Article IV of the Non-Proliferation Treaty," in SIPRI 1974 op. cit., p. 204.

9. Bertrand Goldschmidt, L'Aventure Atomique (Paris: Fayard, 1962), pp. 46-47.

10. See for example Leneice N. Wu, "The Baruch Plan: US Diplomacy Enters the Nuclear Age," Subcommittee on Foreign Affairs, U.S. House of Representatives (Washington: GPO, August 1972). That the climate of opinion in the House was

conducive to the adoption of this kind of proposal may be seen in the July 1946 attack of the HUAC on scientists accused of seeking to end military restriction as part of a plan to form "some kind of world government." See Richard G. Hewlett and Oscar E. Anderson, Jr., The New World: 1939/1946 (University Park: The University of Pennsylvania Press, 1952).

11. Hewlett and Anderson, op. cit., pp. 468-69, 496-98, 523-24, 527, 529; and Goldschmidt, 1962, op. cit., pp. 51-53.

12. The British seemed most concerned with securing French patent rights while the Americans were concerned about a breach of military security through contact with Communist Frederick Joliot-Curie, the head of the Commissariat à l'Energie Atomique. Hewlett and Anderson, op. cit., pp. 331-33.

13. For example, it was considered essential for morale purposes that the Los Alamos lab conduct research on the "constructive applications of nuclear energy" while pursuing its main objective of weapons design and research. Hewlett and Anderson, op. cit., p. 626.

14. When Du Pont exercised its option to give up the management of the Hanford Works immediately after the end of the war, General Electric was persuaded to step in to take over these responsibilities only after the government committed itself to providing $10 million for the construction of a G.E. nuclear research facility at Schenectady. Ibid., p. 629.

15. For a treatment of the American pattern of government ties with private industries in comparison with other countries, see J. E. Hodgetts, Administering the Atom for Peace (New York: Atherton Press, 1964), esp. pp. 90-93.

16. For a legal analysis of the AEC's role see Georges Fischer, L'Energie Atomique e Les Etats-Unis (Paris: R. Pichon et R. Durand Anzias, 1957).

17. See for example Thomas Morgan, Atomic Energy and Congress (Ann Arbor: University of Michigan Press, 1956); and for JCAE-AEC ties see Robert A. Dahl and Ralph S. Brown, Jr., Domestic Control of Nuclear Energy (New York: SSRC, 1951); and Harold P. Green and Alan Rosenthal, Government of the Atom (New York: Atherton Press, 1963).

18. See for example Thomas E. Murray, Nuclear Policy for War and Peace (New York: World Publishing Co., 1960), Ch. 7.

19. Harold Nieburg, Nuclear Secrecy and Foreign Policy (Washington: Public Affairs Press, 1964), p. 70.

20. William B. Bader, *The United States and the Spread of Nuclear Weapons* (New York: Pegasus, 1968), pp. 26-35.

21. Robert J. Donovan, *Eisenhower: The Inside Story* (New York: Harper and Row, 1956), Ch. 13. Nieburg cites five different kinds of pressures that led to the relaxation of the policy of nuclear secrecy: 1) the military's desire for more flexibility in dealing with allies regarding nuclear defense; 2) British pressure for nuclear weapons cooperation with the United States; 3) American scientists' demands for greater freedom of communication in research and for new arms control initiatives; 4) the dissatisfaction of industry with government restrictions; 5) the competitive impulse provided by the independent development of nuclear energy in Britain and Canada. Nieburg, 1964, *op. cit.*, p. 73.

22. While Soviet suspicions blocked the creation of an IAEA fissile materials pool, the United States bilateral agreements and the United States-Euratom Agreement also undercut the functions of the IAEA. But in a more general sense, the failure of nuclear energy to develop as rapidly as expected reduced the international role of the IAEA--and was attributed by some to American policies. Both the 1960 McKinney Panel report to the JCAE and the Smyth 1962 Report to the State Department were critical of American policy. The first attributed the failure of American policy to the government's lack of support for commercial nuclear power, and the lack of a massive international joint research effort; the second blamed the failure on the generally bad economic prospects of nuclear energy which made other nations unwilling to compromise their sovereignty through international collaboration with the United States. Nieburg, 1964, *op. cit.*, p. 115, 121.

23. Arnold Kramish, *The Peaceful Atom in Foreign Policy* (New York: Harper and Row, 1963), p. 18, 230.

24. There are several examples of the doctrine of inevitability. In 1957 the AEC Chairman Strauss expressed the view that "With time the operation of atomic reactors all over the world is inevitable. It can no more be prevented than one could restrict or prohibit the use of fire."[a] A decade later, this idea was still current. "...there are inexorable laws governing the flow of scientific information. Nuclear technology is like any scientific skill; it soon becomes the hallmark of a modern society. ...this skill finds its inevitable place in industrializing and modernizing societies..."[b]

[a] Cited in Warren Donnelly, "Commercial Nuclear Power in Europe: The Interaction of American Diplomacy with a New Technology," U.S. Congress, Jouse

Sub-Committee on National Security Policy and Scientific Development Affairs (Washington: GPO, December 1972), p. 47.

[b] Bader, op. cit., p. 21.

There is a tendency here to subordinate politics to technology without appreciating the dynamic interrelations of the two terms: while in the short run, political decisions are circumscribed by technological parameters, in the longer run technological parameters are the result of prior political decisions. Unlike fire, nuclear energy does not occur naturally; it is the result of a complex set of interrelated material and intellectual structures. Far from being an infallible indicator of "modernity," a nation's level of attainment in nuclear technology is indicative more than anything else of the amount of money devoted to acquiring sophistication in nuclear technology.

25. Cited in Nieburg, op. cit., p. 86.

26. Ibid., p. 69; Goldschmidt, 1962, op. cit., p. 102.

27. Kramish, op. cit., p. 64, 172-87. Goldschmidt, 1962, op. cit., pp. 139-43. Even less plausible are the claims that the US was merely following the example of Russia, Britain, Canada, France, and Japan, closely followed by Sweden, Switzerland, West Germany, and Communist China.[a] Of these nations, in 1953 only Britain can be considered a serious commercial rival in the American dominated world market.

[a] Nieburg, op. cit., p. 86.

28. The successful operation of the Calder Hall reactor from October 1956, seemed to establish Britain's primacy in nuclear energy.[a] Considerations of commercial competition with the British were of sufficient concern to lead one analyst to conclude that American willingness to finance Euratom research but not the OEEC's nuclear energy agency research was due to Britain's participation in the latter but exclusion from the former.[b]

[a] Henry Nau, National Politics and International Technology (Baltimore: The Johns Hopkins Press, 1974), p. 131.

[b] Donnelly, op. cit., p. 114.

29. To compensate for this shortfall, the 1956 McKinney Panel Report recommended the promotion of 1,000,000 kwh abroad by 1960, more than projected American domestic nuclear capacity. "Report of the Panel on the Impact of

the Peaceful Uses of Atomic Energy," Joint Committee on Atomic Energy, Vol. 1, January 1956 (Washington: GPO, 1956), p. 97.

30. Basically, there were two types of agreements--research and power agreements. Their success was a result of the United States government's willingness to 1) allocate fuels; 2) adopt firm pricing policies; 3) give authority for American companies to deal directly with foreign customers, without the AEC as intermediary; 4) and provide financial aid for fuel purchases.[a] There were also generous terms for research reactor purchases--half the cost (up to $350,000) was an outright gift, the other half financed through the United States Import-Export Bank. By 1960 when these terms expired, twenty-six reactors had been exported under these provisions.[b] The terms of power reactors were more of a problem since the principle had been established that the United State's government should offer foreign customers no better terms than domestic customers. Since there was political opposition in Congress to direct government financing of electric power, especially among conservative Republicans, the terms for the export of power reactors were less attractive than for those of research reactors. The lack of interest abroad in importing American power reactors under these bilateral terms led to the special arrangements under the United States-Euratom Joint Program in 1958.

[a] Donnelly, op. cit., pp. 38-44.

[b] Kramish, op. cit., p. 179.

31. These revisions were the result of the kinds of pressures described above (cf. footnote 21). While they liberalized the terms of nuclear secrecy in order to promote commercialization, they also allowed limited sharing with Great Britain in nuclear weapons technology. While Dulles and Eisenhower were prepared to extend this nuclear aid to France, at least in nuclear submarines, the JCAE was adamantly opposed, the result being a policy of discrimination among allies that retarded French nuclear development but provided them with the political determination to persist. Bader, op. cit., pp. 26-35; Nieburg, op. cit., p. 184. See also George Ball, The Discipline of Power (Boston: Little, Brown, 1968), pp. 96-107.

32. The European nations demanded collectively the same right to self-inspection that Britain and Canada enjoyed under their Tripartite Agreement with the U.S. While some in Congress undoubtedly saw this concession as a contribution to European unity, Dulles at least made it clear that Administration support for Euratom went only so far as promoting nuclear energy, explicitly rejecting Euratom's broader

political aspirations.[a] By blocking European efforts at the independent construction of a uranium enrichment facility, while promoting LWRs dependent upon enriched uranium fuels, the American policy promoted a Community nuclear industry dependent upon America.

[a] Donnelly, op. cit., pp. 75-76.

33. The United States-Euratom Joint Program was enthusiastically supported by the American nuclear industry because of the stimulus it was expected to give the commercialization of nuclear power.[a] The government responded with especially attractive terms for reactors--of the total $350 million estimated capital cost of the proposed 1,000 NWe installed capacity to be exported, the U.S. government arranged for financing $135 million through the Import-Export Bank; the foreign utilities were expected to finance the $150 million equivalent to conventional plant costs, and the difference of about $65 million was to be variously financed.[b] Given the projections in A Target for Euratom--goals based on American data that could be met only through imports of American technology and hardware--the United States expected an enthusiastic response. While European Governments were interested, European utilities were concerned about the high costs and uncertain performance of nuclear plants--and while deadlines for submitting projects were extended, eventually only three reactors were brought under the aegis of the program, one of which would have been built even without this aid.[c] Industry sources in America were very disappointed--by 1960, it seemed that commercial nuclear energy was farther away than ever before.[d] But the generally negative assessment of the Joint Program must be seen in a broader perspective: the export of three LWRs created a certain momentum, and those supplied to France and West Germany were crucial in determining future national choices among various types of reactors. This program also gave an impetus for the formation of overseas subsidiaries, joint ventures, and licensing arrangements between American nuclear industries and European counterparts which were to have important long term implications.

[a] U.S. Congress, Joint Committee on Atomic Energy Hearing, "Proposed Euratom Agreement," 85th Congress, 2nd Session, 1958, p. 267, 329.

[b] Donnelly, op. cit., p. 105.

[c] Nau, op. cit., p. 138.

[d] Chauncy Starr in Bulletin of the Atomic Scientists, XVI, January 1960, p. 31.

34. This may have been true of the Italian Latina plant and of the Japanese Tokai Mura plant. The desire for independence should not be equated, of course, with the desire for a nuclear weapons option. It should also be noted that until 1964, the economic advantage of the American over the British reactor types was not well established; reactor orders of the natural uranium fueled type after that date (like Argentina's) are much more indicative of a desire for nuclear independence since they are taken against the background of the general consensus on the economic superiority of the American enriched uranium fueled reactor type. See for example Duncan Burn, The Political Economy of Nuclear Energy (London: Institute of Economic Affairs, 1967).

35. Regarding these early reactor export competitions, see Lee C. Nehrt, International Marketing of Nuclear Plants (Bloomington: University of Indiana Press, 1966).

36. For an early treatment of the arms control implications of exporting LWRs see Arnold Kramish, "A Reexamination of the Nuclear Proliferation Problems Presented by World-wide Requirements for Enriched Fuel: Relating the February 1965 Options to Today," RAND, P-3923, August 1968.

37. These subsidies take various forms. In the United States, the most important are the direct subsidization of nuclear research and development; government production of enriched uranium at prices that do not reflect the full market value and without capital commitment on the part of industry; government provision of waste disposal services; the insurance subsidy provided through the provisions of the Price Anderson Act; and increasingly the cost of safeguards and security measures that are partly borne by the government. See Ralph Nader, "Who Benefits," The Center Magazine, March/April 1975, p. 33.

38. Because nuclear technology is so capital intensive and the profits have been as yet rather slim, only the largest enterprises can maintain themselves in the nuclear field. In Europe, this has led to government sponsored consolidations resulting in markets dominated by a single British government consortium, one major and one minor group in France both working under license to American multinationals, and a giant German group. Of the major industrial countries, Japan and Italy show the least degree of concentration in the nuclear sector--but in each case the three or four major combines in the nuclear field operate as licensees of foreign companies.

39. See for example Achille Albonetti, "Accesso degli Stati militarmente non-nucleari--che hanno rinunciato alla produzione, all'acquisto e all'utilizzazione delle armi nucleari--alle technologie per l'utilizzo dell'energia nucleare," Nazione Unite, Conferenza degli State non-dotati di armi nucleari, giugno 1968.

40. For representative Indian statements see U.S. Arms Control and Disarmament Agency, Documents on Disarmament, 1967, pp. 229-39, 430-40. For Brazialian statements see ibid., pp. 225-27, 368-72.

41. "Final Communique," Conference of Non-Nuclear Weapons States in Ibid., pp. 677-84.

42. Ibid., pp. 312-15.

43. Ibid., pp. 613-15.

44. A practical objection to immediate inspection of the United States nuclear industry is the technical and financial strain it would place on the IAEA.

45. Lawrence Scheinman, Atomic Energy Policy in France under the Fourth Republic (Princeton: Princeton University Press, 1965), pp. 76-79.

46. ACDA Deputy Director Adrian Fisher described Article IV as constituting a "legal obligation of the parties to cooperate" in peaceful nuclear technology. See ACDA, Documents on Disarmament, 1968 (Washington: GPO, 1969), p. 14.

47. Goldschmidt in SIPRI, op. cit., p. 205.

48. In signing the NPT, the governments of West Germany, Italy and others felt it necessary to make lengthy statements of their own interpretations of the Treaty.

49. The United States now faces this problem with the reported requests of the Iranian government for nuclear fuel reprocessing facilities.

50. While European countries had begun to question reliance on the United States for fuel supplies at least as early as the mid-1960s, Japan didn't give much official attention to the problem until 1971 when the JAEC set up an enrichment study group. See the Japan Atomic Energy Commission White Paper (Tokyo, 1973), pp. 51-59.

51. This has been under study by the AEC and the Atomic Industrial Forum since 1966. In June, 1968, the AIF released a report urging the prompt transfer of enrichment plants to the private sector.[a] Industry's enthusiasm began to flag

as the terms of takeover became clearer. As early as 1970, an industry spokesman noted that the more that was learned about the enrichment process the less interested industry was in an immediate takeover.[b]

[a] USAEC, Annual Report to Congress, 1968 (Washington: GPO, 1969), p. 31.

[b] Nuclear Industry, December 1970, pp. 19-20.

52. Nuclear Industry, November 1969, p. 3. The Administration's adoption of this policy fit its budgetary priorities in that the burden of financing needed plant expansion would fall to private industry.

53. The AEC was caught between the White House and the JCAE on the question of the future of the enrichment facilities. While a majority of the Commissioners supported the Administration move, albeit with reservations, the Commissioner closest to the JCAE dissented. See the statements of Seaborg et al. and Ramey in Nuclear Industry, July 1971, pp. 6-9.

54. The JCAE's Hosmer Came to favor a TVA-like government enrichment corporation;[a] Holifield opposed the privatization plan in part because of the negative effects he judged this would have on the economic competitiveness of nuclear power.[b] Over time, industry leaders seemed to come to a similar conclusion since ultimately financial considerations compelled them to abandon for the time being any attempt to take over the government's gaseous diffusion complex.[c]

[a] Nuclear Industry, October 1973, p. 3.

[b] Nuclear Industry, February 1970, p. 38.

[c] Edward Cowan in The New York Times, July 17, 1974;

55. In hearings before the JCAE, an AEC spokesman admitted that these price hikes had been enacted by the AEC without consultation with the State Department or foreign customers. U.S. Congress, Joint Committee on Atomic Energy, Congress, 1st Session, 1971, Part 2. p. 13.

56. International Herald Tribune, March 5, 1970. Initially, the consortium involved little technical exchange: essentially three national prototype plants were built with technological sharing planned for later stages. See Edward Wonder, "Uranium Enrichment in American-European Relations: The Politics of Providing New Enrichment Capacity," October 1974 (mimeo).

57. It has been argued that this attempt at controlling an undesirable line of technological development simply reduced American capabilities without impeding the development of the European capabilities. See Victor Gilinsky and Bruce L. R. Smith, "Civilian Nuclear Power and Foreign Policy," RAND: P-3592-1, February 1968.

58. The New York Times, June 22, 1971, p. 39.

59. Nuclear Industry, July 1971, pp. 5-10. This program was designed to give as many as twenty-five American industries access to gaseous diffusion and centrifuge technology so as to allow them to evaluate the prospects for a private enrichment venture. The stringent requirements for access dampened the interest of industry and they demanded more open policies on the part of the AEC.

60. Atomo e Industria, November 1, 1969.

61. The Commission eventually recommended a four stage program that would have included centrifuge technology as well as gaseous diffusion. See Achille Albonetti, "l'Economie Energetique et la Politique Nucleaire Europeenne" (Paris: Institut Atlantique, mars 1972), pp. 74-75.

62. Donnelly, op. cit., p. 134.

63. Clyde Farnsworth in The New York Times, January 1, 1975. The terms of the agreement call for Iran to put up $1 billion (1/3 the plant's estimated cost) in return for 10 percent of the plant's output of enriched uranium.

64. Asahi Journal, August 6, 1971, pp. 117-19.

65. American offers to share gaseous enrichment technology with "friendly countries" and for "due compensation" elicited considerable interest on the part of other governments in 1971 but neither the terms nor the timing were favorable to this proposal. The offer was revewed again in the winter of 1973-74 when Secretary Kissinger offered to share enrichment technology in return for cooperation among the industrial countries in meeting the challenge of the oil crisis. These offers provoked opposition in Congress and within the administration, and were not taken very seriously abroad. See James Reston, International Herald Tribune, January 31, 1974.

66. See David Smith, "What Price Commercial Enrichment?" Nuclear Engineering International, July 1974, pp. 572-84.

67. Mainichi, November 26, 1969; and The Japan Times, January 29, 1974. The assurances of the IAEA that Japan would be accorded equal treatment under inspection provisions with the Western European members of Euratom, and the pressure from the United States led the Japanese Atomic Industrial Forum to change its position and urge ratification of the NPT. Asahi, March 7, 1973.

68. The Japan Atomic Energy Commission decided on a program aimed at securing short-term supplies from the United States, medium-term diversification of supplies through international cooperation in enrichment ventures, and a long-term national enrichment capability within the decade of the 1980s. JAEC 1973 White Paper, op. cit., pp. 51-59.

69. Mainichi, January 18, 1974. And Newsweek, February 4, 1974, p. 37.

70. While sensitive about Japanese and other foreign investment in Australian raw materials, especially uranium ores, the Australian government has agreed to a feasibility study aimed at the realization of an enrichment plant that would use Australian uranium, Japanese capital, and third-party technology. Cooperation with the centrifuge consortium nations is possible, but Japan's nuclear energy laws prohibit the kind of classification of technology that Holland has demanded; cooperation with France would be easier if limited to the purchase of technology--but the Australian government will not permit France to purchase uranium ores unless France signs the NPT and submits to inspection by the IAEA. See Asahi, May 14, 1974; Kenneth Randall in The Far Eastern Economic Review, November 15, 1974, pp. 39-41. and Nuclear Engineering International, February 1975, p. 74.

71. Japanese companies have contracted for 1,000,000 SWU/y from 1980-90 out of a total plant capacity of 9,000,000 SWU/y. Le Monde, Selection Hebdomadaire, 19-25 décember, 1974, p. 8.

72. Apparently it was only after these offers were made public that the administration gave any thought to special precautions that nuclear exports to volatile areas like the Middle East might require. Even those who were generally critical of these offers were not prepared to require NPT ratification as a precondition for nuclear aid. See for example the editorial in The New York Times, June 10, 1974.

73. See the statement of Under Secretary Sisco in "The Export of Nuclear Technology," Special Report n. 9, Department of State, Bureau of Public Affairs, October 1974.

74. A Soviet-Egyptian power reactor agreement has been announced. See Nuclear Energy, November 1974, p. 51.

75. Although American policy makers seem confident of their ability to manipulate other nations' nuclear policies, there is little evidence to suggest that this is likely to be successful in the future.

A pertinent example is the American attempt to block the development of the Italian nuclear naval propulsion program. Italian aspirations in naval propulsion were opposed in the late 1950s and early 1960s because they aimed at development of a nuclear submarine. While the United States aided Britain's submarine program and considered aiding France's, it chose to oppose Italian ambitions. Then, Italian plans shifted to a surface naval vessel. While the United States were prepared to aid German and Japanese surface naval propulsion programs, the Italian ship was opposed by the United States government: financed by the Italian navy, it was considered by the United States a military use of nuclear energy. But by the late 1960s, the United States no longer had an absolute monopoly of enriched uranium fuels necessary to block the Italian program: the French Commissariat à l'Energie Atomoque agreed to provide the fuel load for the land-based reactor prototype and promised the first fuel load the completed ship. At present, it seems very unlikely that the ship will be built due to Italian domestic bureaucratic and budgetary problems. In the past the United States was successful in blocking a nuclear program of which it did not approve. But domestic political and economic obstacles are now the only effective check on this particular program. See Steven J. Baker, "Technology and Politics: The Italian Nuclear Program and Political Integration in Western Europe," unpublished Ph.D. dissertation (Los Angeles: University of California, September 1973), pp. 125-29.

76. France is reportedly prepared to sell nuclear submarines to Iran.[a] The West German and Brazilian governments are negotiating for the sale by German industries of several nuclear reactors, a fuel reprocessing plant, and a uranium enrichment plant based on the nozzle separation process.[b]

[a] The Washington Post, December 12, 1974, p. 33.

[b] Nuclear Engineering International, April, 1975, pp. 305-6.

77. The international situation has provided Indians with repeated opportunities to debate a nuclear option since the late 1950s. The cumulative impact of the international

crises of 1970 and 1971 in which Indian security and prestige seemed to be diminished may be sufficient to explain the Indian decision to demonstrate a nuclear device. But it is also interesting to explain why the decision was not altered after India's triumph in the Bangladesh war in late 1971, which appreciably improved India's international position, and why the test was allowed to take place only days before the international Aid India Consortium met to consider Indian economic aid requests, opening India to international scorn and possible economic sanctions. The growing power of the Atomic Energy Department and of those in the military who had long favored a nuclear demonstration was very likely crucial to the decision; the increasing independence of the Indian nuclear energy program was also probably a consideration; and finally, the anticipated favorable impact on public opinion--giving P. M. Gandhi's government a rare opportunity to demonstrate its effectiveness in the midst of an increasingly chaotic domestic situation--was surely a relevant consideration. These kinds of domestic political considerations help to explain a sequence of events difficult to adequately account for otherwise. Where these kinds of domestic political conditions prevail, a future decision to go nuclear may result from considerations even less linked to objective international conditions than the Indian decision appears to have been; international crisis may be at best the occasion for the final incremental step in an essentially bureaucratic policy process. For a treatment of Indian nuclear policy that stresses the domestic aspects see Peter King, "How Wide is a Nuclear Threshold? India and the Bomb," Australian Outlook, August 1971.

78. America's self-proclaimed role as "watchdog" over Japan's political evolution, justified as helping to avoid the extremes of the Communist left and militarist right, is full of equivocation.[a] In particular, there is evidence that American policies are designed to reduce the Japanese public's opposition to nuclear weapons.[b]

[a] See Albert Axelbank, Black Star over Japan (Tokyo: Charles C. Tuttle Co., 1972), Ch. 10.

[b] See T. J. Pempel, "Japan's Nuclear Allergy," Current History, vol. 68, n. 404 (April 1975).

79. Although Indian preparations for a nuclear test could not have gone unnoticed by the United States government, there is little evidence of American pressures to prevent India from testing--despite Indian dependence on the United States for economic aid and supplies of enriched uranium

fuels for its America-supplied power reactors. Clearly, the administration calculated that such pressures would be ultimately unsuccessful and/or too politically costly to even attempt.

80. See Robert Gilpin, France in the Age of the Scientific State (Princeton: Princeton University Press, 1968).

81. See Mason Willrich and Theodore B. Taylor, Nuclear Theft: Risks and Safeguards (Cambridge, Mass.: Ballinger Publishing Co., 1974).

82. Given the limited quantities of exploitable uranium ores, the future economic viability of nuclear power may depend on plutonium as a fuel. This will be all the more true if plutonium-fueled liquid metal fast breeder reactors (LMFBR) are developed commercially.

83. Security measures like those outlined by Willrich and Taylor will be essential as dependence on nuclear energy increases; but while they may be relatively unobtrusive when applied to fifty American power reactors and related facilities, they will be very intrusive when applied to hundreds of reactors and related facilities. The size and scope of the powers that a federal nuclear security force must have to operate effectively are additional reasons to question the advisability of the heavy dependence on nuclear energy. While the nuclear industry does not necessarily agree with all the Willrich and Taylor recommendations, there is industry support for the idea of a federal nuclear security force. See for example the AIF's James E. Sohngen's comments in Willrich, Taylor, 1974, op. cit., Appendix E.

84. With the retirement of Congressmen Holifield and Hosmer and the division of the AEC's functions between the Energy Resources and Development Agency and the Nuclear Regulatory Commission, the Congressional initiative seems to have passed to critics of nuclear energy like Senator Ribicoff and the Senate's Government Operations Committee. Ribicoff has proposed to tighten controls over nuclear exports, a controversial move opposed by nuclear industry spokesmen and government bureaucrats. For example, ERDA head Robert D. Seamans warned that the unilateral tightening of export controls "could cripple U.S. nuclear exports" and could cause a "dangerous erosion of our influence in international nuclear affairs." Stephen E. Nordlinger, Baltimore Sun, May 1, 1975.

85. If a nuclear option is a question of national security, of "high politics," one would expect cost to be no object. To the extent that a nuclear weapons option may be a matter

of national prestige and/or domestic politics, cost factors could be critical. In the future, and for some of the potentially most troublesome nations, these "low politics" kinds of considerations may be most important. The nuclear weapons capabilities of less developed countries may be very sensitive to the economics of nuclear power. See for example Ciro Zoppo, "Toward a U.S. Policy on Nuclear Technology Transfer to Developing Countries," California Arms Control and Foreign Policy Seminar, Santa Monica, July 1971.

86. Jerome S. Katzin, "Effects of Inflation and Recession on Nuclear Project Financing in the U.S.A.," Nuclear Engineering International, March 1975, vol. 20, n. 226, pp. 184-86.

87. See President Ford's statement in Nuclear Industry, January 1975, p. 7.

88. See for example Michel Turin, Centrales Nucleaires: Un Pari Au-dessus de Nos Forces," Entreprise, n. 1012, 30 january-5 february 1975, pp. 54-60.

89. This might be construed as a contravention of Article IV of the NPT, scrapping any pretension at giving NNWSs technological compensations for Treaty adherence. For international political reasons, it might be better to undertake domestic policies that would restrict the export of nuclear technology without any direct Treaty contravention. The apparent suspension of the international shipment of fissile materials by the NRC might be an example. The NRC was able to counter the complaints of European critics by arguing that the suspension resulted from a change in domestic administrative procedures. See Clyde Farnsworth in The New York Times, April 23, 1975.

90. From a "transnational politics" perspective, it is interesting that Prime Minister Palme claims to have taken his energy programs from the Ford Foundation's 1974 study, A Time to Choose. For a comprehensive survey of Swedish nuclear energy policy see Jerome H. Garris, "The Atomic Energy Debate in Sweden and the U.S.," draft prepared for delivery at the Annual Conference of the Society for Advancement of Scandinavian Studies, Madison, Wisconsin, May 2, 1975.

91. The Ford proposals call for an additional 200 nuclear plants on line by 1985, and proposes government help to achieve this goal through speeding-up licensing procedures and improving the utilities' financial position. Nuclear Industry, Vol. 22, n. 1, January 1975, pp. 7-8.

92. Some parts of the United States government have taken steps in this direction. The NRC has suspended plans for plutonium recycle in LWRs for three years[a] while the EPA has called for a delay of four to twelve years in the development of the LMFBR.[b]

[a] David Burnham, The New York Times, May 8, 1975.

[b] Edward Cowan, The New York Times, April 28, 1975.

93. For example, Westinghouse was in favor of supplying Italy with the fuel necessary for its naval propulsion program. See footnote 75 above.

94. See for example Paul C. Szasz, "International Atomic Energy Agency Safeguards," in Mason Willrich, ed., International Safeguards and Nuclear Industry (Baltimore: Johns Hopkins University Press, 1973), pp. 73-141.

95. Lawrence Scheinman, "Safeguarding Nuclear Materials," Bulletin of the Atomic Scientists, Vol. XXX No. 2, April 1974.

96. For a general treatment of this kind of problem see Edwin M. Kinderman, "Industrial Implications of Safeguards," in Willrich, Ed., op. cit., pp. 201-23. The AEC is reportedly unable to account for several tons of enriched uranium as a result of its operations; whether this is the result of the enormous scale of operation or bad materials accounting procedures is not clear. See David Burnham, The New York Times, Sunday, December 29, 1974, p. 26.

97. ACDA Director Fred Ikle has voiced similar concerns. The nations mentioned in this context--Argentina, Brazil, Israel, Libya, Taiwan, South Korea, Pakistan--are not the nations that the superpowers have been most concerned about in the past as prospective sources of nuclear proliferation, nations like West Germany and Japan. But several are nations that have relied primarily upon imported sources of nuclear technology, especially from the United States. See Leslie Gelb, The New York Times, April 10, 1975, p. 3.

NUCLEAR PROLIFERATION: QUESTIONS AND ANSWERS

(By the U.S. Arms Control and Disarmament Agency)

THE PROBLEM

What is meant by the expression "nuclear proliferation"?

The term refers to the spread of nuclear weapons to countries which do not now have them.

How many countries now have nuclear weapons?

There are five avowed nuclear-weapons countries. They are, in the order in which they acquired nuclear weapons, the United States, the Soviet Union, the United Kingdom, France, and the People's Republic of China. A sixth nation, India, has tested a nuclear device which it has described as a peaceful nuclear explosive.

Why should we be concerned if other nations acquire nuclear weapons?

A world of additional nuclear-weapons nations would be inherently less stable than the present one because of the increased danger that regional conflicts might involve nuclear weapons. This could result in global nuclear war should the United States and the Soviet Union be drawn into the regional, nuclear confrontation.

Given the size and effectiveness of the American nuclear arsenal, what is the direct danger to our national security in a nuclear-proliferation world? Need we fear a nuclear attack on ourself or our allies from any new nuclear-weapons country?

Clearly, the threat of retaliation by U.S. nuclear or conventional forces could deter a nuclear attack against us or our allies by any rational nuclear power. But there would exist the awesome danger of nuclear terrorism in a proliferated world. It could even become difficult to determine the origin of an attack, especially if the bombs were smuggled in. Dr. Fred Ikle, Director of the U.S. Arms Control and Disarmament Agency, described a bleak outlook for our country in a world with many nuclear powers when he posed these questions to a National Press Club audience: "Could we build up massive new defensive systems? Would we have to erect tightly closed borders? Would we be driven in desperation to establish a police state in an effort to prevent nuclear terrorism here? . . . It makes absolutely compelling the need to forestall an uncontrollable proliferation of nuclear explosives."

For the past 25 years the outbreak of war between the United States and the Soviet Union has been precluded by the fear of mutual retaliation, the so-called strategy of nuclear deterrence. Why wouldn't nuclear deterrence work in the case of lesser rivalries?

The nuclear balance between the two superpowers has remained stable because the nuclear forces of both sides are relatively invulnerable to attack. Thus, neither side is able to launch a preemptive, nuclear first-strike without suffering unacceptable damage in a retaliatory strike. Smaller countries that have just reached nuclear threshold could not afford to make their weapons systems invulnerable and they lack the advanced technology to remove the fear of accidental launch. They therefore would invite a preemptive attack from their nuclear rivals, making the nuclear relationship between small countries highly unstable. The successful operation of a nuclear deterrent strategy as we know it is impossible under these conditions.

Isn't there an international treaty aimed at halting the spread of nuclear weapons?

Yes, the Nonproliferation Treaty (NPT) entered into force in 1970, and has now been signed by 109 countries, 95 of which have formally adhered. This treaty binds nuclear-weapons parties not to transfer nuclear weapons to any other country and commits non-nuclear-weapons parties not to manufacture or otherwise acquire them. The treaty also has a positive obligation: the promotion of nuclear technology for peaceful purposes.

Has the treaty ever been violated?

No, the parties have faithfully lived up to the basic commitments.

Then what is the worry?

The danger is that a nation not a party to the NPT might divert nuclear resources—such as equipment and fissionable materials—from peaceful uses to weapons use. The problem lies in the inherent dual nature of nuclear energy. Like fire, it can be used beneficially or destructively. The technology for peaceful uses can, with a sufficient effort, provide the building blocks for the manufacture of nuclear weapons. Also, there is the possibility that the NPT might be violated in the future, or parties might withdraw from it.

What is meant by peaceful purposes?

Nuclear technology can be used for medical research and industrial and farm application, but its primary use is in the generation of electricity. As nations, developed and developing alike, seek new sources of energy, they are turning to nuclear technology. The number of research and power reactors using low-enriched uranium as the fissionable material is increasing rapidly.

There are already over 274 reactors operating, under construction, or planned in 26 countries other than the United States. By the end of 1974, 221 nuclear power plants, totaling nearly 215,000 megawatts of capacity, were operational, under construction, or on order in the United States. Estimates vary, but it is generally accepted that the total generating capacity by nuclear reactors will increase 25 fold by the end of this century.

TECHNOLOGICAL ASPECTS OF NUCLEAR PROLIFERATION

There have been recent news articles and TV programs which seem to suggest that it is easy to build a bomb. Is this true?

It is true that one can read about the general principles of how an atomic bomb works in most good libraries, and that some fairly detailed descriptions of how a nuclear device is constructed are available in unclassified technical literature. While the principles underlying the operation of a nuclear weapon are relatively well known, however, constructing a device is the very difficult and hazardous part, even for those with advanced scientific and engineering skills. Not one bomb could be built, even by trained specialists, if they did not first obtain a significant amount of fissionable material. Nations which have acquired significant quantities of fissionable materials for a nuclear device have found it necessary to expend hundreds of millions of dollars for production facilities. So; the fabrication of a nuclear explosive device would be very difficult, requiring sophisticated skills and expertise in chemical and conventional explosive technology, metallurgy, engineering, and nuclear reactor physics, as well as the fissionable material.

What does a country need to acquire a nuclear-weapons capability?

Either highly enriched uranium or plutonium is the key ingredient for making a nuclear bomb. The process of enriching natural uranium to a grade suitable for bombs requires a facility which is quite expensive. (Even a small plant would cost hundreds of millions. At today's prices, if the three U.S. plants had to be replaced, the cost would be on the order of $10 billion.) Plutonium can be obtained as a by-product of the operation of a nuclear power reactor (which uses natural or low-enriched uranium as the fissionable material) to generate electricity, but could not be used for nuclear weapons unless separated in a chemical reprocessing plant. In addition to acquiring the fissionable materials, a country would have to have the technical expertise to design and fabricate the weapons.

What does "enriching" uranium mean and how is it done?

Natural uranium has three natural isotopes—U–234, U–235, and U–238, with the last making up about 99% of the total. Enrichment technologies are methods to raise the percentage of U–235. Of the natural-occurring isotopes, only U–235 has sufficient fission properties to work in reactors of the type utilized by the United States—or a bomb. Power plant reactors generally use low-enriched uranium (3%–5% of U–235) while highly enriched uranium (more than 20% of U–235) is required for a nuclear bomb.

Is enriched uranium or plutonium readily available to most countries?

No. Enriched uranium used in research and power reactors is currently being provided by a few supplier nations under cooperative agreements.

You say "currently." Does this suggest a temporary situation?

A few supplier nations will probably continue to furnish most of the materials needed, at least for the near future, but there have been recent developments leading toward "self-sufficiency" on the part of some nations.

Who are the supplier nations?

The suppliers of enriched uranium are the United States, the Soviet Union, the United Kingdom, and France. The principal suppliers of natural uranium are Canada, South Africa, Gabon, and the Central African Republic. The United States, the Soviet Union, the United Kingdom, France, and the Federal Republic of Germany are the principal suppliers of power reactors and other facilities and equipment.

What about plutonium? Is this imported in the same manner as uranium?

No. Plutonium is a byproduct of the operation of a reactor using enriched uranium as fuel. Once the uranium is "burned out" the fuel rods containing the spent material, and the plutonium produced in the process, are removed from the reactor. The plutonium can be separated from the waste material by a chemical process.

Is this technically difficult or costly?

It is not simple. A reprocessing plant is required. Although the technology for these plants is fairly well known, the experience and engineering know-how to construct an efficient plant is difficult and costly to acquire. Furthermore, to be economically feasible for reactor fuel purposes—that is, to make it pay to extract plutonium for fuel rather than buying a fresh supply of uranium—a nation would require a facility capable of processing at least 1,500 tons of spent fuel a year. Such a facility would cost on the order of a half a billion dollars, and would require a large amount of electrical power to operate. Of course, reprocessing can be done on a smaller scale if the only purpose is to extract a limited amount of plutonium.

What is meant by "fuel cycle"?

The fuel cycle means the various stages in the production of nuclear energy. It begins with the mining and refining of the raw uranium, which then moves through a conversion plant (where the uranium is changed from powder to gaseous form—a necessary step for enrichment), an enrichment plant, and a fabrication plant (where the uranium in pellet form is placed in fuel rods), to the reactor where the fission process take place. The next step is a reprocessing plant where plutonium, some uranium, and waste material are separated. The plutonium and the waste are stored, and the uranium is sent to an enrichment plant to start through the cycle again. At a future date, when uranium resources are scarce, plutonium may be recycled to be mixed with uranium for reactor fuel.

What are the vulnerable points in the fuel cycle?

There are two types of vulnerability. In the case of criminal groups, the vulnerable points are when access can be gained and when the material is safe to handle. For plutonium, that must be after the reprocessing operation. The most likely points for clandestine diversion by a government are the enrichment plant or the reprocessing plant since at these stages there is less precision in accounting for the materials in the safeguards system.

PROTECTIVE MEASURES—THE IAEA AND INTERNATIONAL SAFEGUARDS

At what point did the United States and the world in general recognize nuclear proliferation as a threat to international security? After all, President Eisenhower in 1953 through his "Atoms for Peace" program advocated wide dissemination of nuclear technology.

Even as the "Atoms for Peace" program was launched, steps were taken to build an international institution that could safeguard against diversion for military purposes while facilitating cooperation in peaceful nuclear technology. The International Atomic Energy Agency (IAEA) was the result of this effort.

What is the IAEA?

It is a self-governing organization with headquarters in Vienna, established under the auspices of the United Nations in 1957. It is financed by its 106 member nations; its annual budget currently runs to $33.3 million, $5.2 million of which are used for safeguards. The staff numbers about 1,000 and includes scientists and technicians who devise and implement safeguards techniques and inspections. The Agency's safeguard system covers all facilities throughout the nuclear fuel cycle. It constitutes the international community's first attempt to establish, on a worldwide basis, a system of inspection and control of an industry of potential strategic importance.

How is it determined which peaceful nuclear facilities will be subject to IAEA inspection?

First of all, IAEA safeguards apply to recipients of materials and technical assistance provided by or through the IAEA. Additionally, supplier nations can avail themselves of IAEA safeguards coverage in lieu of, or supplementary to, direct bilateral verification arrangements between the supplier and the recipient. Any of the IAEA member nations can request that IAEA administer safeguards at specified facilities within their jurisdiction, or even covering their entire peaceful nuclear program. Lastly, parties to the Treaty for the Prohibition of Nuclear Weapons in Latin America and to the Treaty for the Nonproliferation of Nuclear Weapons are required to have IAEA safeguards coverage to verify treaty compliance.

What is the Treaty for the Prohibition of Nuclear Weapons in Latin America?

It was signed in Tlatelolco, a section of Mexico City, in 1967 and basically provides for a Latin American nuclear-free zone. In addition, it commits each party to "negotiate multilateral or bilateral agreements with the International Atomic Energy Agency for the application of its safeguards to its nuclear activities."

How does the IAEA safeguards system work?

The Agency has a corps of inspectors who regularly visit peaceful nuclear facilities in those countries which are members of the IAEA or whose facilities fall under IAEA safeguards by agreement. The inspection procedures are generally compatible with the nuclear management methods that are already employed at the facility because of the high monetary value of nuclear material and the potential hazards from uncontrolled radiation. IAEA safeguards are applied to the flow of nuclear materials using instruments and other techniques at "strategic points." The implementation of this system has four main elements; an examination of design information of nuclear facilities, facility records, reports to the agency, on-the-spot inspection to verify compliance with the safeguards agreement.

Are IAEA safeguards effective?

They are effective in monitoring the operation of a facility to make sure that diversion has not taken place. They cannot prevent such diversion. They are more in the nature of a burglar alarm than a lock, but one cannot discount the value of an alarm in inhibiting the burglar. Safeguards serve as a strong deterrent to the diversion of materials. There is no indication that diversion has ever occurred in any facility under IAEA inspection.

Which countries have facilities that are not covered?

Almost all nuclear facilities owned by non-nuclear-weapons nations, even if not parties to the NPT, are subject to IAEA safeguards. These arrangements are governed by trilateral agreements among the supplier, the recipient, and the IAEA. However, agreements with non-NPT parties are of limited duration and coverage. Egypt, Israel, India, and Spain have some facilities with no IAEA inspection of any kind.

What is the likelihood that the technology and a quantity of fissionable material could be stolen or otherwise fall into the hands of terrorists or criminal groups?

The degree of danger varies with the fissionable material. Uranium of the grade used in most power reactors is not suitable for making explosives and therefore is relatively safe from the likelihood of falling into hostile hands. Highly enriched uranium, of the type used in research reactors, is at least theoretically vulnerable. Plutonium becomes vulnerable only after it has been separated from the spent fuel in the reprocessing operation, since spent fuel rods are so radioactive that criminal groups would have difficulty in handling them. Even after plutonium has been separated out, it is an extremely toxic substance and dangerous to handle. Physical protection of fissionable materials is primarily the responsibility of the country involved, but the increasing commerce in peaceful nuclear activities makes the inherent danger of theft or sabotage a matter of worldwide concern.

DUAL NATURE OF NUCLEAR TECHNOLOGY

Isn't there an inherent contradiction in the purposes of the Nonproliferation Treaty? On the one hand, it is designed to prevent proliferation, but on the other hand, it promotes nuclear technology for peaceful uses.

Not a contradiction, but there is an inherent problem. The negotiators of the treaty knew that a way must be found to insure that promotion of nuclear technology for peaceful purposes did not result in the addition of any more countries possessing nuclear weapons.

Is there assurance that this will not happen?

There can be no absolute assurance that it will not happen but provision was made in the treaty to guard against the possibility. Each non-nuclear-weapons party agrees to accept IAEA safeguards on its peaceful nuclear facilities "for the exclusive purpose of verification of the fulfillment of its obligations . . . with a view to preventing diversion of nuclear energy from peaceful uses to nuclear weapons or other nuclear explosive devices."

What is meant by "other nuclear explosive devices"?

A device which may be used for a peaceful engineering purpose, such as extraction of minerals or gases from the earth, building canals or harbors, or diversion of water.

Why should nuclear explosive devices for such peaceful projects be prohibited by the treaty?

Because the technology of making these devices is indistinguishable from that of making nuclear weapons. It is the U.S. view that it is impossible for a non-nuclear-weapons country to develop a nuclear explosive device for peaceful purposes without in the process acquiring a device that could be used as a nuclear weapon.

Why does the prohibition seem to apply only to nations which do not have nuclear weapons?

This is necessary if the spread of nuclear weapons is to be prevented. To avoid any actual discrimination, the NPT provides for arrangements to insure that any potential benefits of this technology will be made available to non-nuclear-weapons countries that join the NPT, through appropriate international procedures and at the lowest possible cost.

Have any projects been carried out under this provision?

No. To date no peaceful nuclear explosion (PNE) project has ever gone beyond the stage of preliminary feasibility studies. Moreover, although the United States and the Soviet Union have had research, development, and testing programs on PNEs for a number of years, numerous questions remain with respect to their economic and technical feasibility.

India has stated that its nuclear device is a part of a program to develop nuclear explosions for peaceful purposes only. Isn't that all right?

The U.S. Chief Representative to the Conference of the Committee on Disarmament (CCD), Ambassador Joseph Martin, Jr., pointed out the danger in this way: "The critical question is not whether we can accept the stated intentions of any country, but whether a world in which many States have the capability to carry out nuclear explosions—and in which all therefore fear the nuclear-weapons capability of others—would not be vastly less secure than a world that has successfully contained the spread of nuclear explosive technology."

Apart from India, are there other nations which have the potential resources to build nuclear devices which have not signed the Nonproliferation Treaty?

Yes, this category could include Israel, Pakistan, Brazil, and Argentina, among others.

What is the stated reason why these countries have refused to sign the NPT?

The reasons vary among the "holdouts" but they fall into two main categories: apprehension about security from aggression by a neighbor and the claim of discrimination in the development of nuclear energy for peaceful uses.

Have all nuclear-weapons countries signed the NPT?

France has not signed it, but has stated that it will act as if it were a party to the NPT and thus far has done so. The People's Republic of China has stated that it feels the NPT is inherently discriminatory, perpetuating a situation that is advantageous to the more industrialized countries while relegating the less developed countries to a stature of permanent inferiority in the nuclear field. India has refused to join because of a stated belief that safeguards and restrictions on the production of fissionable material should be applied equally to nuclear and nonnuclear states. In addition India has contended that a nonproliferation treaty should not prohibit any peaceful use of nuclear energy or technology—including PNEs.

FUTURE INITIATIVES

It seems that the Nonproliferation Treaty is not the perfect answer.

The Nonproliferation Treaty is the foremost legal instrument we have in the international community for inhibiting the spread of nuclear weapons. Universal adherence to the NPT regime must be encouraged insofar as possible. In accordance with a provision of the treaty, a Review Conference was held in Geneva in May 1975 to determine if the objectives of the treaty were being met and to explore ways in which adherence could be widened.

What was the finding of the Review Conference?

The basic commitments of the treaty—not to transfer or acquire nuclear weapons—have been faithfully honored by all the parties to the treaty. In addition to observing this fact, the Final Declaration of the Review Conference, adopted by consensus, urged wider adherence to the treaty and made a number of constructive recommendations.

What can be done to encourage additional countries to adhere to the treaty?

The United States believes that the central objective of the treaty—to halt the spread of nuclear weapons—is in the interest of every nation. We recognize, however, that each nation will want to take into account the technical, economic, and political considerations involved in reaching this decision. The "hold-out" nations must be convinced that all or a combination of these considerations would make it in their interest to become a party.

Take them in order. What are the technical aspects?

The technical and economic aspects are closely related. To develop a peaceful nuclear industry, most nations must import nuclear assistance. The NPT calls on all parties to facilitate "the fullest possible exchange of equipment, materials, and scientific and technical information . . ." It commits nations in a position to do so to contribute to the further development of applications of nuclear energy, especially for the benefit of treaty parties. The NPT Review Conference recommended that this concept of preferential treatment for NPT parties be strengthened through both bilateral and multilateral channels. Special recognition was given to the importance of export credit financing for acquiring nuclear power reactors and fuel.

What are the political considerations?

This is a more complicated area; they vary with different countries. Some general observations can be made, however. A primary question which arises when a country is considering the renunciation of nuclear weapons is that of its security. This problem is solved for some nations by alliance arrangements, but not for all. U.N. Security Council resolution, adopted at the time the NPT was being negotiated, recognized that nuclear aggression, or the threat of nuclear aggression, created a situation requiring immediate action by the Security Council. The concept of nuclear-free zones, with pledges of respect for the nuclear-free nature of the area by outside powers, is recognized by the NPT, was discussed at the Review Conference and is gaining support. The CCD is making a special study of this approach.

What about nuclear disarmament by the nuclear powers? Didn't the three nuclear powers which are parties to the treaty commit themselves to this objective?

Yes, the NPT obligates all parties "to pursue negotiations in good faith on effective measures relating to cessation of the arms race at an early date and to nuclear disarmament . . ." SALT is the most important but not the only example of negotiations being pursued toward this end. During the past year, the United States and the Soviet Union have been engaged in 10 separate negotiations, bilateral or multilateral, related to "cessation of the arms race."

If significant nations continue to stay outside the framework of the NPT, what else could be done to lessen the dangers of nuclear proliferation?

It will be necessary for supplier countries to exercise restraints in providing nuclear assistance to countries not parties to the NPT. Secretary of State Kissinger told the U.N. General Assembly in September 1974 that the policy of widely supplying nuclear fuels and other nuclear materials cannot continue if it leads to the proliferation of nuclear explosives.

Isn't there a high degree of competition among commercial enterprises in the supplier countries? How can one or a few nations afford to exercise restraint?

Some progress has already been made by principal supplier nations in cooperatively working out certain minimum standard requirements for IAEA safeguards on their exports of nuclear equipment, as well as on fissionable materials, to non-nuclear-weapons countries which are not party to the NPT. The NPT Review Conference similarly urged that in all achievable ways common export requirements relating to safeguards be strengthened.

What could be done to strengthen the safeguards system to protect against diversion?

One approach to solving the problem of diversion of plutonium, which also has some economic advantages, would be for the nations in each region to use a single multinational reprocessing plant. Under such an arrangement all or nearly all of the spent fuel in a region could be efficiently reprocessed in a large plant, while under strong, uniform safeguards, with no single country owning the plant. The NPT Conference strongly recommended a study of regional or multinational nuclear fuel cycle centers as an advantageous way to satisfy, safely and economically, the needs of many countries for nuclear fuel reprocessing, nuclear waste disposal, and other services, while at the same time facilitating physical protection and the application of IAEA safeguards.

What can be done to protect against criminal groups?

More stringent regulations governing physical protection in the storage and transportation of fissionable materials might be agreed to in an international convention. Additionally, countries could cooperate in police work to combat theft attempts.

NPT: PARADOXES AND PROBLEMS

(By Anne W. Marks, Editor)

Recommendations and Conclusions

It was the general view of the participants at Divonne that they should focus on the upcoming NPT Review Conference and seek to provide recommendations which might gather enough support to be felt there. A series of recent developments has underlined the urgency of the issues to be discussed at that Conference. Our discussions covered many aspects of the non-proliferation issue beyond the framework of the Treaty, some of which were felt to be of great significance for the constraint of proliferation and the reinforcement of international security.

The recommendations and conclusions presented here are based on a generally held view that the present Treaty, while far from perfect, is a useful and workable instrument. Two questions nevertheless confront the Review Conference: the question of amending the existing Treaty text, and the question of implementing its provisions. It was widely argued that attempts to amend the Treaty in a substantive fashion at the Review Conference are likely to prove ineffective. At the same time, it was felt that the most notable shortcomings in the present operation of the Treaty clearly result from the failure of the nuclear-weapon parties to carry out its provisions and to fulfill obligations undertaken by them at the time of its negotiation. The recommendations which follow are therefore directed particularly to steps which can help to ensure that the purposes of the Treaty and its Preamble are realized.

1. The Arms Race

The nuclear-weapon parties should begin to fulfill their obligations under Article VI of the NPT to "pursue negotiations in good faith on effective measures relating to the cessation of the nuclear arms race at an early date and to nuclear disarmament, including a treaty on general and complete disarmament." In particular, they should initiate a substantial reduction in strategic nuclear delivery vehicles, pursue measures to limit further missile flight testing, and, most importantly, proceed promptly to negotiate a Comprehensive Test Ban.

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To meet their obligations under Article VI, the United States and the Soviet Union must take more positive action than has been evidenced so far. Three steps in particular are of major importance.

First, the actual process of general strategic disarmament must begin with reducing the number of strategic nuclear delivery vehicles. We are confident that an immediate and substantial reduction in numbers of strategic nuclear delivery vehicles would pose no threat to the security of either side, and would set in motion the mechanism for a firm schedule of further reduction.

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Second, measures to limit or prohibit further qualitative advances in the strategic arms race must be combined with such reductions. Strict limitations in the numbers of missile flight tests will make the capacity of either side to develop new MIRVs or increase accuracy on their missile warheads (both potentially destabilizing steps), significantly more difficult. Such controls can be readily verified through national technical means, as established by the SALT Agreements of May 1972.

Third, a Comprehensive Test Ban. The absence of a total ban on testing continues to symbolize the failure of the nuclear superpowers to exercise restraint in arms development, in particular in the technological nuclear arms race. The recent signing of the "threshold" test ban treaty by the United States and the Soviet Union was a disheartening step backward, for instead of evidencing an intent to stop nuclear testing over time, it appears to license it. A threshold of 150 kilotons yield (ten times the size of the Hiroshima bomb) permits the development of most weapons the U.S. and U.S.S.R. are likely to want. In setting an effective date of March 31, 1976, the agreement permits testing of those larger weapons which would be outlawed after that date. In authorizing "underground nuclear explosions for peaceful purposes" without any restriction, the parties are raising problems which are discussed under Recommendation 3.

While efforts must continue to get France and China to join the negotiations for a Comprehensive Test Ban, their failure to do so should not be allowed to hold up agreement. Provisions similar to those in earlier arms control agreements can always be included to allow the parties to withdraw if continued testing by non-parties vitally affects their security.

2. Security Against Nuclear Threats

As the U.N. Security Council Resolution 255 and the associated declarations on security assurances are widely regarded as inadequate, and, in the opinion of many states, meaningless, the nuclear powers should be prepared to take more realistic action, including at least an offer along the lines of a pledge of an appropriate type not to use or threaten to use nuclear weapons against a non-nuclear party to the Treaty. Regional moves toward nuclear-free zones patterned along the lines of the Treaty of Tlatelolco should also be encouraged as another means of allaying fears of nuclear threats.

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A major concern of the non-nuclear-weapon states during the negotiation of the Non-Proliferation Treaty was the extent to which their commitments under the Treaty would weaken their national security, leaving them prey to nuclear aggression. The nuclear powers responded to this problem of nuclear insecurity with the tripartite Security Assurances Resolution, adopted by the UN Security Council on June 19, 1968. Even then, this measure fell short of what many non-nuclear-weapon states thought necessary. Moreover, at the present time, it is generally agreed that it has no practical value. International events since that time have undermined the effectiveness of the resolution to the point where it has lost all practical value. It is imperative that consideration be given to alternate forms of security assurances, or arrangements which can more adequately allay the real fears of the non-nuclear-weapon parties and take into consideration the problems of some non-parties. Two possible solutions which have often been discussed at the international negotiating table deserve serious attention.

One possibility involves a pledge by the nuclear powers never to be the first to use nuclear arms against a non-nuclear-weapon party to the Treaty unless that party is engaged in armed attack in concert with a nuclear-weapon power. Such a non-use undertaking on the part of the nuclear powers would meet the specific demands of various non-nuclear non-parties. Moreover, so far as the nuclear powers are concerned, it involves no more than an extension of their commitments under the Treaty of Tlatelolco (the Treaty for the Prohibition of Nuclear Weapons in Latin America). A precedent can be found in Protocol II to that Treaty in which four of the nuclear powers have pledged to respect the nuclear-free zone established in Latin America and not to use or threaten to use nuclear weapons against the member states in the zone.

The formulation suggested for the pledge would automatically make exception in the case of conflict embarked upon by a non-nuclear-weapon state formally allied to a nuclear-weapon power, if that power undertook supporting military movements. On the other hand, it would protect non-nuclear-weapon parties from the threat of nuclear blackmail in the pursuit of their national security policies. There have been a variety of other non-use agreements discussed, ranging from an absolute agreement to one which does not apply to any allies of a nuclear power.

The proposals have been discussed in the context of agreed types of non-use pledges to parties to the NPT because that is the context which is now under consideration. This does not preclude negotiation of an agreed type of pledge of more general application in another forum.

Another approach to alleviating national security problems posed for non-nuclear-weapon nations surrendering the nuclear option is a regional one, that of nuclear-free zones. The experience of negotiating the Latin American Nuclear-Free-Zone (The Treaty of Tlatelolco) has shown that proposals for denuclearization in various parts of the world have the advantage of treating separately the special political, strategic, and technical problems of each region. Above all, such zones can offer increased security because they are negotiated among the states involved.

Mutual assurances of the renunciation of nuclear weapons in a given area, with provision for satisfactory verification, can provide more security than pledges by the nuclear-weapon states alone. Proposals for Middle East and South Asian nuclear-free zones have recently been made. The African states may wish to pursue a similar project. Proposals for nuclear-free zones have been made in Europe. The great powers should respect such zones as are agreed upon.

3. "Peaceful" Nuclear Explosions

In view of the differing understanding of the value and practicality of "peaceful" nuclear explosions (PNEs), a study should be made by a group of experts appointed by the Secretary General of the United Nations to examine the political, safety, security, economic, and technical aspects of the PNE program. This group should include the varied disciplines necessary to make a broad study and should be initiated without waiting for the Review Conference.

Two suggestions were made in this context: namely, that a moratorium on all further PNE tests be imposed pending the results of this study, and that there be an international regime to supervise all peaceful nuclear explosions of all states, should they be continued or resumed. However, there are some who would support one or the other of the two suggestions only in the context of the control of military uses of nuclear energy, including a Comprehensive Test Ban.

* * * * *

At the time the NPT was signed in 1968, there were high hopes in some quarters that the economic benefits from the use of peaceful nuclear explosives might turn out to be impressive, and Article V was placed in the Treaty to ensure that the non-nuclear-weapon countries would enjoy any potential benefits on a non-discriminatory basis. It was pointed out, however, that in the intervening six years the United States had spent many millions in pursuit of practical, economic applications for its "peaceful" explosions program ("Plowshare"). Despite this and despite the fact that the U.S. has had intensive experience with this particular technology, no particular success has been achieved.

There continues to be controversy on the real potential of PNEs and there are not sufficient analyses available about the costs, numbers of explosives needed, alternative methods of doing the tasks, or the environmental and health risks to settle the argument. Moreover, since PNEs and nuclear weapons can only be differentiated by their intent, such explosions raise serious problems for effective nuclear arms control.

One view expressed was that PNEs were incompatible with nuclear arms control and should therefore be prohibited altogether. Another view was that it was not practical or acceptable to prohibit PNEs, especially for the developing countries, unless all nuclear tests were forbidden. But this latter was acceptable, according to still another, only if safeguards were to be applied to the peaceful nuclear activities of *all* powers.

In view of the divergencies of opinion about the value and practicality of PNEs, proposals were made that a broad new study be undertaken by the UN Secretary General of the potential benefits and possible disadvantages that might result from a program of peaceful nuclear explosions, and that every peaceful application be evaluated in terms of alternative methods of accomplishing the same purpose. All information, except the details of explosive design, should be freely available to all interested parties, in order that every nation be on an equal footing in determining its true national needs.

It was pointed out by one of the participants that the International Atomic Energy Agency was required under its Statute to carry out such studies, and also that the United Nations had been holding a series of conferences on the peaceful uses of nuclear energy, including PNEs. Nevertheless, there was general support for the study proposal, providing it considered—in addition to the technical aspects—the political, safety, and economic questions involved. If and when, after the study, "peaceful" nuclear explosions were considered feasible and desirable, it was proposed that they be carried out under an international regime.

In any event, it was agreed that should the proposal for a study be implemented, it need not—and indeed should not—await the convening of the Review Conference. And in the meantime, it was proposed, a moratorium should be declared on all such "peaceful" nuclear explosive tests, although some did not accept the idea except in the context of a ban on all nuclear tests.

4. Civilian Nuclear Assistance

Article IV of the Non-Proliferation Treaty recognizes the "inalienable right" of all parties to full participation in all peaceful nuclear activities, except for the manufacture of nuclear explosive devices. In order to avoid discrimination between party and non-party states, nuclear assistance by any state (whether or not party to the Treaty), in the forms of nuclear material and technology, should go only to non-nuclear weapon states which have agreed to accept approved IAEA safeguards on all their peaceful nuclear programs.

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Included in the Article IV pledges of assistance and cooperation is an undertaking by parties "in a position to do so" to contribute to civilian nuclear applications of the non-nuclear-weapon states, and particular mention of the needs of the developing countries is made. These provisions were included in the Treaty in response to complaints about its nuclear-non-nuclear weapons imbalance and to encourage accession by the promise of assistance to NPT states.

The drafters of the NPT doubtless saw the entry of power reactors into national energy economies taking place at a somewhat less rapid pace than the oil crisis now seems to permit. The heightened interest and activity in nuclear power as a large part of the answer to worldwide energy demands has brought the issue of compliance with the commitment to assistance in this technology into sharp focus.

The NPT places primary emphasis on preventing the diversion of nuclear materials from civil to weapon use. Today, however, the nuclear-weapon states (who, along with certain non-nuclear-weapon states, are major suppliers of nuclear fuels for civil use) cannot continue to regard the Treaty in such narrow terms; a healthy treaty must take into account the commercial and economic possibilities inherent in civil use, and must place as strong an emphasis on the exploitation and sharing of benefits as it does on the responsibility for its potential dangers.

The fuel produced in uranium enrichment facilities is essential for the operation of most nuclear power plants in operation now and until the end of the century. States relying on nuclear fuel for power resources have been dependent for years on others (particularly the United States) for the fuel essential to the operation of their power plants. Articles III and IV of the NPT, read wisely together, can provide a framework (through the establishment of a system of international participation in critical elements in the fuel cycle) on which national security, safety to peoples and their environment, and economic independence from fossil fuels can be built.

The NPT safeguards requirements are not designed to accomplish all this, nor should they be. What they can do, and in fact are beginning to do, is place in motion a process that demonstrates that controls can be made to work, and much less intrusively than was originally thought. The responsibility assumed by the International Atomic Energy Agency under the Treaty, and the technical and political effort required to fulfill it, has already produced a unique and creative dichotomy between national and international entities engaged in the development of nuclear energy. Building on what has been done so far, it is possible to develop a system of multinational participation in, and international supervision of, the critical elements of the fuel cycle which will give to the parties to the NPT the assurance that they can obtain, on a non-discriminatory basis, the materials and facilities necessary for their power programs.

Parties to the NPT in a position to supply nuclear assistance should discontinue a practice which has the effect of discriminating *against* the non-nuclear-weapon states that have become parties to the NPT.

Non-nuclear-weapon parties to the Treaty have agreed to accept safeguards on *all* source or special material in *all* peaceful activities, while at the same time such materials are being sold by some parties to countries not party to the Treaty under safeguards applying *only* to the particular materials being transferred.

There was discussion whether this practice is in violation of Article III. Opinions have been expressed on both sides of the issue, but no matter which view is correct, the practice is inconsistent with the purposes of the NPT. It serves as a disincentive to states joining the NPT. It also tends to undermine the effectiveness of the safeguards system itself. In the first place, safeguards are more effective when they are applied to *all* nuclear facilities inside a state.

Some participants argued that parties to the NPT should supply no nuclear materials except to other parties and that a concerted policy of all supplier countries is desirable to avoid the misuse of supplies.

It was also suggested that there should be a prohibition of any exchange of nuclear materials and technology between parties and non-parties to the NPT. This would provide an inducement for potential suppliers of nuclear materials and technology to adhere to the Treaty.

Another view was that in order to eliminate the existent discrimination between nuclear-weapon states and non-nuclear-weapon states parties to the Treaty, all recipients of nuclear equipment, whether weapon-states or not, should accept the same safeguards.

It was also suggested that in order to remove obstacles to the formation and operation of multinationally owned nuclear enterprises and in order to facilitate the extension of IAEA safeguards to as much of the world's nuclear industry as practicable, nuclear assistance should be provided only if such materials and equipment (and all materials produced with such materials) were subject to IAEA safeguards.

One view was that a much more serious discrimination in the Treaty lay in the provision which required safeguards on *all* nuclear programs of non-nuclear-weapon states, while there were no safeguards at all on any programs of nuclear-weapon states. Such a provision, it was argued, discriminates against developing and non-industrialized countries unable to manufacture their own requirements indigenously.

The Conference recommendation adopts a middle ground and takes the position that, in the future, transfers of nuclear materials to non-parties should be under the same conditions as apply to NPT parties—safeguards on *all* materials in *all* peaceful activities.

5. Safeguards

International and national safeguards systems should be strengthened and made universal. Physical security should be introduced into the system by incorporating appropriate physical security standards which must apply on all materials. Consideration should also be given to safety and environmental concerns.

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It is clear that safeguards, whether applied to the narrow purposes of the NPT, or to the broader, more comprehensive questions accompanying the era of nuclear power, are destined to become a commonplace of nuclear life.

The problem of diversion of nuclear material by terrorists, organized criminals and other non-governmental groups should be given immediate attention. Since there is no doubt that under certain circumstances the possibility of such diversion exists, the risks to the growing nuclear industry and international security are manifest. NPT safeguards, which are aimed at detecting governmental diversion, contain no provision against theft or sabotage by private groups or individuals, and means must be developed to deal with these problems. Regardless of attitudes towards the NPT, all governments have a common interest here, which can logically be addressed through the IAEA. For although the IAEA cannot itself exercise police power, it can, in the new spirit of cooperation between national and international systems, formulate certain standards of physical security which must be applied if nations are to be considered in compliance. The same concern should be applied to industrial accidents and safety standards for handling highly toxic materials.

Part II—A Postscript on the Nuclear Fuel Cycle

During the Conference at Divonne, and concurrent with the discussions, the Conference Secretariat prepared a draft report for the convenience of the participants. The following draft section was not included in the final report because the Conference was unable to devote sufficient time to the subject. It is included here because of the interest it generated, as evidenced by the comment in Recommendation 4 of the Report that "States relying on nuclear fuel for power resources have been dependent for years on others . . . for the fuel essential to the operation of their power plants. Articles III and IV of the NPT, read wisely together, can provide a framework (through the establishment of a system of international participation in critical elements in the fuel cycle) on which national security, safety to people and their environment, and economic independence from fossil fuels can be built." Ed.

Critical elements of the fuel cycle supporting nuclear power programs should, insofar as possible, be co-located in order to minimize the risks of diversion or theft, reduce the costs of nuclear power, improve safety, and assure the availability of source materials and advanced technology to NPT parties. This can be most effectively achieved through international cooperation.

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The uranium fuel cycle is the key to both energy and weapons. Critical elements of that cycle—U-235 separation plants, fuel fabrication facilities, chemical separation plants for processing spent fuel, and storage facilities—should be co-located. In this way, physical security can be greatly enhanced, transportation risks restricted to moving the fuel to the power plant, and the application of safeguards significantly facilitated. Potential weapons materials would thus be outside international supervision only at nuclear power reactor sites, where diversion or theft is extremely difficult so long as IAEA safeguards and reasonable security procedures are in effect.

Large commercial fuel fabrication facilities and chemical reprocessing plants are at present concentrated in a few countries. The fuel itself—principally slightly enriched uranium—is still a virtual monopoly of the U.S., the Soviet Union, and to a lesser extent the UK and France. Small, or less developed countries will not be able to afford the necessary facilities on their own, but can (and for reasons of international economic health, should) share in them according to their needs.

Multi-national participation in large-scale development of nuclear fuel cycle facilities, accompanied by appropriate IAEA supervision or control, should be investigated and encouraged. Enrichment plants, along with fuel reprocessing and fabrication facilities, might be jointly owned by consortia including importing and exporting countries. Enormous political and economic benefits, along with an equal reduction in the risk of nuclear weapon proliferation, can result from such arrangements.

Ideally, the facilities involved would be co-located on "fuel cycle farms" in carefully selected and logical regions of the world in order to minimize the effects of accidents, natural disasters, seizures, and the like, and to afford convenient proximity to power stations. In this way the following needs for a world nuclear energy-based economy can be met:

1) The need for an assured supply of fuel, for freedom from cost fluctuations engendered by commercial competition, and for freedom from political manipulation of the fuel supply. As to the latter, the gap between governmental rhetoric urging multilateral cooperation to deal with the world energy situation and government actions in concluding special bilateral nuclear deals is apparent. Nuclear resources should not be used as political bargaining chips in the oil-rich Middle East or elsewhere. The picture of a cartel restricting a nation's essential supplies of nuclear fuel is disquieting.

2) The economics of nuclear power clearly demonstrate the advantage of large, centralized facilities. The capital investment in uranium enrichment plants for nuclear fuel is too large to be practical for most individual nations. Similar considerations apply to chemical fuel reprocessing plants, and to a lesser extent, fuel fabrication installations. Transportation and physical security are additional cost items which large co-located facilities can lower significantly.

3) Large multinational installations can make technical assistance more effective in providing the benefits of nuclear energy to smaller and less-developed countries. The most advanced technology can and should be made available to such centers without any classification barriers.

4) "Fuel cycle farms" will cut down transport dangers. The plutonium from nuclear reactors is dangerous and complicated to handle. Even if the Soviet Union and China are left out of account, the rate of plutonium production is expected to reach 100,000 kilograms per year by 1985. Co-location of fuel cycle facilities could virtually eliminate the transportation links that are most vulnerable to accident or theft. It is estimated that a million megawatts of nuclear power generation will necessitate seven to 12 thousand shipments of spent fuels between reactors and reprocessing plants annually. Security problems are even more severe in the shipment of the highly enriched, weapons-grade U-235 needed to fuel advanced-design reactors such as the HTGR (high temperature gas-cooled reactor). Great care must be taken that large amounts of such material, as well as the

plutonium created or used in power plants do not fall into the hands of criminal or terrorist groups or be allowed to poison the environment. The imminent entry of the "plutonium recycle" (a process which will allow the use of plutonium as fuel) into the overall process makes co-location even more important.

ALLEGED MARKET FAILURES IN FINANCING U.S. EXPORTS*

(By Joseph M. Burns, Deputy Director of Monetary Research, Office of Assistant Secretary For International Affairs, U.S. Treasury Department)

I. Introduction

The role of the Export-Import Bank in promoting U.S. exports has been widely discussed in editorials and Congressional hearings during the past two years. This discussion was prompted by Congressional review of the need to continue the authority of the Export-Import Bank beyond June 30, 1974.

A number of arguments, both political and economic, have been advanced in support of Eximbank's subsidized loans, guarantees, and insurance: to promote U.S. foreign policy, to improve the U.S. balance of payments, to enhance the level of production and employment, to meet subsidized foreign competition, and to correct for market failures in the financing of U.S. exports. The last of these arguments, correction for market failures, is the most important one from the standpoint of the efficient use of resources.[1] This paper deals with the implications of this argument for the role of the Eximbank.

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*The views expressed in this paper are the author's own and do not necessarily reflect an official position of the U.S. Treasury Department. I wish to thank Barry Chiswick, Henry Wallich, and Thomas Willett for helpful comments. [Reprinted by permission of the author.]

A market failure is a situation in which private markets do not encourage the most efficient level or type of economic activity. Thus, if a market failure in the financing of U.S. exports exists, a case for governmental intervention could be made. The nature and scope of possible intervention will depend on the nature and magnitude of a market failure.

Three market failures in the financing of U.S. exports have been frequently alluded to: (1) inability of private financial markets to provide sufficient long-term financing to creditworthy foreigners; (2) the serious reduction in availability of export credits during periods of tight money; and (3) excessive risk premiums that foreign purchasers are forced to pay to secure financing.[2]

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[1] According to a recent government interagency report, the correction for market failures should be the principal objective of export promotion. Office of Management and Budget, U.S. Government, Interagency Report on U.S. Government Export Promotion Policies and Programs (Draft, February 1975), Chapter I., pp. 2-5.

[2] Cf. Office of Management and Budget, U.S. Government, op. cit., Chapter III, p. 2. In this paper, "long term" refers to maturities extending beyond seven years. In balance-of-payments data, "long term" typically refers to maturities extending beyond one year.

The first two allegations relate to the availability of credit; the last, to the terms of credit. Availability of credit and terms of credit are, of course, interrelated in the sense that sufficiently burdensome terms will render credit unavailable.

These alleged export financing problems are often referred to as market deficiencies, not market failures. However, as this paper points out, deficiencies exist in virtually all markets due, inter alia, to an absence of perfect information. As long as resources devoted to the acquisition of information are responsive to market forces, it is not clear that intervention would be warranted.

The alleged export financing problems are a principal basis for the Eximbank's export subsidization program.[1] This program includes direct loans to foreign purchasers as well as wide-ranging guarantees and rediscount facilities to U.S. commercial banks and insurance to U.S. exporters.[2] The direct loans are designed to enhance the availability of long-term credit and reduce the cost to foreign purchasers of U.S. products. The rediscount facility for export paper held by commercial banks is designed to enhance the availability of export credits during periods of tight money. And the guarantees and insurance serve to reduce risk premiums on private credits to foreign purchasers.[1]

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[1] Cf. Office of Management and Budget, U.S. Government, op. cit., Chapter III, p. 2.

[2] The guarantees are extended to banks directly by the Eximbank; insurance of exporters' foreign credits is extended by the Foreign Credit Insurance Association with Eximbank support.

In the next three sections, this paper examines each of the alleged market failures in the financing of U.S. exports as well as their implication for the role of the Eximbank: Section II examines the lack of long-term financing; Section III examines the discrimination against export credits during tight money periods; and Section IV examines the excessive risk premiums. The principal conclusion of this paper is that the export subsidization typically carried out by the Eximbank cannot be supported on the basis of correcting for market failures.

II. Lack of Long-term Credit

An argument for export subsidization is based on the assumption that private financial markets are unable to provide sufficient long-term financing to creditworthy foreigners wishing to purchase U.S. capital equipment goods.

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[1] Cf. George D. Holliday, "History of Export-Import Bank of the United States," (Washington, D.C.: Library of Congress, March 27, 1975), pp. 22-24; Howard S. Piquet, *The Export-Import Bank of the United States: An Analysis of Some Current Problems*, (Washington, D.C.: National Planning Association, September 1970), Chapter II.

This argument has two facets. First, it is alleged that commercial banks in the major world money markets are unwilling to extend long-term loans on terms beyond the normal five to seven years. Second, it is alleged that foreigners are less able than U.S. purchasers to secure financing through the world's major capital markets.

Re Commercial Banks:

In the past, two factors, inter alia, prevented banks from extending much long-term credit, foreign or domestic, beyond the normal five to seven years: (1) the desire to match short-term liabilities with short-term credits in bank balance sheets; and (2) the doubtful profitability of long-term credits.

Neither of these obstacles is any longer a serious restraint on long-term bank lending. First, long-term liabilities of banks as a fraction of total liabilities have been growing for some time.1/ And U.S. banks have been making term loans of up to ten years in maturity (and sometimes more) for some years now.2/

1/ See Joseph M. Burns, "The Relative Decline of Commercial Banks: A Note," Journal of Political Economy, Vol. 77, No. 1 (January-February 1969), 122-29.

2/ See Statement by Federal Reserve System in Office of Management and Budget, U.S. Government, op.cit., Chapter VI, p.3.

Second, the use of variable rate loans has increased the expected profitability of long-term credits. U.S. banks are increasingly extending variable rate loans in which the lending rate is tied to the prime rate, which, in turn, is related to the current cost of funds.[1/] Similarly, banks in the rapidly-growing Eurocurrency market typically have resorted to variable (or floating) rate loans in which the lending rate is tied to the current cost of funds (usually to the six-month London interbank rate, or LIBO). These variable rate loans have maturities ranging up to fifteen years, sometimes longer. Eurocredits with a maturity of 12 to 15 years are now frequently extended.[2/]

In addition to the two factors, discussed above, which in the past had restrained long-term bank lending, recent events have also had an effect on banks' willingness to extend long-term loans. Prominent bank failures both here

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[1/] See Richard B. Miller, "Everybody's Floating the Loan Rate," The Bankers Magazine, Vol. 158, No. 2 (Spring 1975), pp. 42-45.

[2/] Cf. Yoon S. Park, "Structure and Function of the Eurocredit Market," Euromoney, April 1974, pp. 73-81. It has been argued that variate rate loans are less attractive to borrowers than fixed-rate loans. This may well be true since inflation rates in recent years appear to have outpaced inflationary expectations. This state of affairs, however, may be coming to an end in 1975. But, whether or not such a preference by borrowers exists, it provides no basis for governmental subsidization of fixed-rate loans. Cf. statement by Federal Reserve System in Office of Management and Budget, U.S. Government, op. cit., Chapter VI, p. 3.

and abroad, large losses incurred by banks, and the worsening international payments position of many countries served to make banks more cautious, and thereby restrained them somewhat in their long-term lending during the second half of 1974. The liquid investment preferences of OPEC may have had similar effects.

Tensions and strains in the banking system have diminished in 1975, and the members of OPEC have increasingly been placing their funds in longer-term assets in order to take advantage of yield differentials.1/ For these reasons, it seems unlikely that the willingness of banks to extend long-term loans will continue to be affected adversely.

For U.S. banks, data are not available on the volume of long-term foreign loans (original maturity over seven years). The volume of "term" loans outstanding to foreigners (business loans with an original maturity in excess of one year) -- were only slightly higher, on average, in 1974 than in 1973: such loans were $2.46 billion in 1974 as compared to $2.40 billion in 1973. In the first quarter of 1975, they

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1/ Cf. Arthur F. Burns, "The Current Recession in Perspective," in Board of Governors of the Federal Reserve System, Federal Reserve Bulletin, Volume 61, Number 5 (May 1975), pp. 273-79; and Fred H. Klopstock, "Recycling Arab Oil Money," The Bankers Magazine, Vol. 158, No. 1 (Winter 1975).

increased to $2.53 billion.[1] The recent, small increase in these loans outstanding may have been influenced by the Federal Reserve's removal in January 1974 of the Voluntary Foreign Credit Restraint Program.[2]

The average maturity of foreign term loans by U.S. banks may be increasing. Data compiled by the Federal Reserve Board from quarterly surveys reveal that long-term loans -- domestic and foreign -- as a percent of all term loans increased from about 20% in 1973 to about 27% in 1974.[3] Since the beginning of 1975, however, the percentage has decreased.

In contrast to U.S. banks, banks in the Eurocurrency market apparently increased greatly their long-term lending during 1974: $21.8 billion in new, publicized, long-term credits were extended during 1974, as compared to $16.3 billion during 1973.[4] The bulk of the 1974 credits, however, were extended during the first half of the year.

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[1] See Board of Governors of the Federal Reserve System, Federal Reserve Bulletin, Volume 61, Number 6 (June 1976), p. A-23, and prior issues. Virtually all term loans to foreign business are made by the large commercial banks to which these data apply.

[2] The Voluntary Foreign Credit Restraint program was directed primarily at short-term capital flows. It did, however, try to deal with a few types of foreign term loans. This latter effort may have been thwarted by the bank's use of branch offices to make foreign term loans which previously had been made by the head office.
Cf. Sir Alec Cairncross, Control of Long-term International Capital Movements (Washington, D.C.: The Brookings Institution, 1973) and Henry S. Terrell, "The Foreign Term-Lending Activities of U.S. Banks," International Finance Discussion Paper, No. 23 (February, 1973), Board of Governors of the Federal Reserve System.

[3] I wish to thank Reed Irvine of the Federal Reserve Board for supplying me with these data.

[4] These figures refer only to commitments; the extent to which these credits have been drawn down, used to repay other loans, or redeposited is not known. International Bank for Reconstruction and Development, Borrowing in International Capital Markets, (November 1974 and May 1975), Table 8.

Much of the Eurobank long-term credits have probably been extended to foreigners. The developing countries as a group received about one third of these credits during 1974.[1/]

The important point, however, is that whether or not banks extend a sizable volume of long-term loans, such a consideration does not necessarily justify subsidies to long-term loans. A fortiori, such a consideration does not necessarily justify subsidies only to long-term foreign loans. As long as banks are responding to market forces, it is not clear that intervention would be warranted.

The composition of banks' portfolios is affected by numerous factors. At certain times, one type of asset may be viewed with great favor; at other times, the same asset may be viewed less favorably. Bank reactions to profit opportunities should be encouraged, not discouraged. Indeed, the banking system needs flexibility in order to service the real sectors of the economy in an efficient manner.

Re the Capital Markets

During the late 1960 and early 1970s, foreigners were less able than domestic purchasers to secure funds through capital markets. This was due, in part, to the numerous ad hoc capital controls imposed by industrial countries in

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[1/] International Bank for Reconstruction and Development, *op. cit.*

efforts to deal with balance-of-payments problems.

With the advent of managed floating exchange rates, many of the restrictions on capital flows have been eliminated. European countries still have various restrictions on capital outflows, but these do not apply to outflows which help finance the home country's exports. Furthermore, transactions in the rapidly-expanding Eurocurrency market are entirely free from controls. As a result, long-term capital is now very free to move from the world's major capital markets to foreign countries to help finance capital goods purchases.

New foreign borrowing in all the national capital markets increased dramatically during 1974 - from $5.3 billion in 1973 to $7.7 billion in 1974.1/ This $2.4 billion increase was offset to some extent by a decline of $0.5 billion in new foreign borrowing in the international, or Eurobond, market.

The important point, however, is that whether or not much foreign borrowing does occur in the national and international capital markets, such a consideration does not necessarily justify governmental subsidies to export credit financing. As long as capital markets are respond-

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1/ International Bank for Reconstruction and Development, *op. cit.*, Table 1.

ing to market forces, it is not clear that intervention would be warranted.

The flexibility of capital markets has been constrained somewhat by regulations on the purchase of foreign debt by large U.S. investors. In particular, U.S. insurance companies and pension funds are limited in their ability to purchase foreign debt.[1] However, the flexibility of bank credit, including that in the unregulated Eurocredit market, together with the very competitive nature of most parts of the world's capital markets have probably reduced greatly, if not eliminated, any burden on foreign borrowers.

III. Discrimination Against Export Credits During Tight Money Periods

It has also been argued that export credits face the same problem as the housing industry -- namely, during periods of tight money, the availability of export credits is seriously reduced.

The implicit assumption of this argument is that commercial banks favor domestic customers in periods of tight money. If this were true, the export industry would be faced with an increase in its long-run costs owing to the frequent necessity of incurring start-up costs.

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[1] Cf. Robert J. Parra and John E. Matthews, "The Search for Term Debt -- Problems and Opportunities," Euromoney, March, 1975, p. 31.

There does not, however, appear to be any significant empirical evidence to support this argument. For example, total export credit, as reported under the Voluntary Foreign Credit Restraint Program, increased much more in 1973 than in 1972 despite the fact that monetary restraint was greater, on average, in 1973 than in 1972 and total bank loans and investments grew less in 1973 than in 1972. In particular, total export credit increased by $915 million (or 28 percent) in 1972 and by $2,038 million (or 48 percent) in 1973; while total bank loans and investments increased by 15 percent in 1972 but by only 12 percent in 1973.1/

The special rediscount facility for acceptable export paper may have prevented banks from discriminating against export credits during tight money periods. Banks have in fact used this facility more during tight money periods.2/ This increased usage, however, probably did not affect the relative volume of exports, since banks are free to use the rediscount facility for any purpose. Indeed, the principal effect of this facility is to provide a subsidy to

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1/ See Office of Management and Budget, U.S. Government, op. cit., Chapter III, p. 12.

2/ Cf. Office of Management and Budget, U.S. Government, Chapter III, p. 13.

banks, and this subsidy may well interfere with the Federal Reserve's ability to carry out its policy.[1]

The important point is that even if banks did in fact curtail their export credit more than in proportion to total loans and investments during periods of tight money, subsidization of export credits would not necessarily be justified. As long as banks are responding to market forces, it is not clear that intervention would be warranted.[2]

IV. Excessive Risk Premiums

It has also been argued that foreign purchasers of U.S. products are unable to get credit except on terms which are unduly burdensome. In particular, it is frequently alleged that foreign purchasers are forced to pay an excessive risk premium for financing. (Foreign purchasers who are unable to secure any financing may be viewed as facing an infinite risk premium.)

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[1] Unlike the general discount facility, this special rediscount facility is not under Federal Reserve control. Even with Federal Reserve control, a rediscount facility is not immune from problems. Cf. Joseph M. Burns, "Academic Views on Improving the Federal Reserve Discount Mechanism: A Review Essay," Journal of Money, Credit, and Banking, Vol. 5 (February 1973), pp. 47-60.

[2] In the case of housing, the situation is somewhat different. The government-imposed interest rate ceilings on the deposits of savings and loan associations and mutual savings banks effectively prevent them from accommodating the housing industry as well as they could during tight money periods. To overcome this institutional distortion of the market, a case for subsidization may be made. In this situation, however, the optimal policy would be the elimination of the institutional distortion, as the Financial Institutions Act recommends.

There is no question that risk premiums on loans to foreign purchasers are typically very high. But, high risk premiums are also faced by many domestic borrowers. Indeed, high risk premiums do not necessarily justify governmental subsidization of loans to foreign purchasers.

There are, however, several factors which do affect the risk premiums of foreign borrowers but do not affect, or do not affect as much, those of domestic borrowers. These factors include the risk attached to changes in the exchange rate, the incremental commercial risk arising from the smaller degree of information about foreign borrowers' financial condition and prospects as well as integrity, and the political risks arising from possible inconvertibility of local currencies, expropriation, or war.[1] For these reasons, ceteris paribus, the risk associated with foreign lending will be higher than that involved in domestic lending.

The incremental risk of foreign loans should presumably be reflected in higher interest charges. Indeed, it must be recognized that those who extend loand to foreigners must be compensated not only for the greater probability of default but also for the willingness to bear higher risks, and that this compensation will not necessarily be insignificant in amount. Thus, the higher interest rates on foreign loans do not necessarily provide justification for government intervention.

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[1] To the extent that contracts are written in U.S. dollars, the risk arising from changes in exchange rates is reduced, but the risk of commercial insolvency will be enhanced.

Two of the factors contributing to the incremental risk premiums on foreign loans are discussed below:

(a) The small degree of information about foreign purchasers' creditworthiness:

The large degree of uncertainty about the creditworthiness of many foreign borrowers is probably due in large part to a deficiency of credit information, which, in turn, is attributable principally to a lack of market incentives to acquire this information. The financial and real sectors of an economy are interrelated, and a developing country will not have the incentive to develop its financial sector to the degree of specialization existing in a developed country.[1/] Indeed, if a developing country did have the same degree of financial specialization as a developed country, there would probably be a very large misallocation of resources.

[1/] Cf. J.R. Hicks, Capital and Growth (London: Oxford Univ. Press, 1965), Chapter 23; and Joseph M. Burns, "On the Effects of Financial Innovations," Quarterly Review of Economics and Business, Volume 11, No. 2 (Summer 1971), pp. 83-95.

In short, information is not a free good -- real resources must be devoted to its acquisition. Imperfect information exists in virtually every market in the world. The greater imperfections in foreign credit markets do not necessarily justify governmental intervention.[1/] As long as resources devoted to the acquisition of credit information are responding to market forces, it is not clear that intervention would be warranted.

A market failure in the acquisition of credit information may, however, exist. For example, no single U.S. exporter of a certain product may be willing to undertake the cost of opening up a new foreign market, since other firms could exploit the information he obtained. In this situation, private returns would be less than social returns.[2/]

1/ Cf. Jagdish Bhagwati, "The Theory and Practice of Commercial Policy: Departures from Unified Exchange Rates," Special Papers in International Finance, No. 8 (Princeton: Princeton Univ., 1968), p. 12.

2/ Cf. Bhagwati, op. cit., p. 13; and Harry G. Johnson, "Optimal Trade Intervention in the Presence of Domestic Distortions," in Baldwin et al. Trade, Growth, and the Balance of Payments (Chicago: Rand McNally, 1965), p. 27.

This externality might justify a subsidy to the acquisition of information in a particular credit market for a limited period of time.

It should be noted that this argument for subsidization could apply to potential domestic markets as well as foreign ones. For it to apply only to potential foreign markets, externalities must be assumed to exist only in foreign markets.[1/]

Enhancement of information about potential foreign purchasers could be carried out by subsidizing credit-rating firms, banks, or exporters. Alternatively, the Eximbank itself, or together with the Commerce Department, could gather and disseminate information on the credit-worthiness of potential foreign purchasers of specific goods in new markets for a limited period of time.

The method of subsidizing the acquisition of credit information should presumably be determined on the basis of cost-benefit considerations. The degree of expertise that an institution already possesses would probably be an important factor affecting the choice. It would appear that subsidization of credit-rating firms might be the most efficient way of subsidizing the acquisition of credit information in a new foreign market.

[1/] See Bhagwati, op. cit., p. 13.

The Eximbank has not, in fact, supported credit-rating firms. Furthermore, the data acquired by Eximbank and the Commerce Department apply principally to experience with past borrowers rather than to information about potential new borrowers. Thus, there does not appear to be empirical evidence that the Eximbank has carried out its program of support for U.S. exports in the manner posited by the infant industry argument.

In addition to the infant industry situation, there may be other situations in which governmental intervention would be warranted. For example, there may be economies of scale over a wide range of output in the acquisition and dissemination of credit information in certain markets. If this were the case, a monopoly would presumably be formed, and the level of information would be lower and the price higher than would be obtained under competitive conditions. Furthermore, even if economies of scale were not present over a wide range of output, a monopoly in the acquisition and dissemination of information could of course exist.

In these situations, a market failure would exist, and governmental intervention might be justified in order to secure a greater amount of information as well as a lower price. There is, however, little empirical evidence that monopolies (a bank or credit-rating firm) exist in the acquisition of credit information about foreign purchasers.

The U.S. Government has the responsibility of examining continuously the market conditions in the provision of credit information about foreign purchasers and of eliminating U.S.-based monopolies or mitigating their effects (in the case of natural monopolies).

If a foreign-based monopoly in the provision of credit information exists and the foreign government does not intervene, the U.S. might want to subsidize the acquisition of information by U.S. banks or credit-rating firms in order to help the U.S. take advantage of an inherently profitable opportunity to export. In this situation, the Eximbank would, in effect, be seeking to mitigate the effects of a market failure in another country.

(b) The large political risks:

It may be desirable for the Eximbank to insure against political risks or to support such insurance by private companies. Private firms might not be able to assess adequately the Government's ability to obtain relief from foreign actions directed at U.S. investors. In such situations, the private evaluation of risk would be higher than the social evaluation.[1] Information provided by the

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[1] Cf. Bhagwati, op. cit., p. 13.

Government might not be sufficient to remedy this externality owing, inter alia, to its lack of credibility.[1] In this situation, insurance against political risk at a subsidized rate would appear to be warranted.

Furthermore, even if private firms could assess well the U.S. government's ability to obtain relief, they still might be entitled to governmental support. Some foreign governments, through various actions or inactions, are responsible for the political risk facing U.S. exporters. In this respect, the behavior of foreign governments may be viewed as an institutional distortion of the market. The optimal solution would be to remove the distortions. Although this may be impossible for the U.S. Government to do, there are two ways in which the Government can reduce the distortions.

First of all, if the U.S. Government is a more efficient collector of foreign repayments than the private sector, it should support the private sector's collection efforts. It is not clear that the government is a more efficient collector. At one time, govermental intervention to secure repayments took the form of actual and potential military intervention as well as the forcible supervision of the finances of the debtor country.[1] In the post-World War II era, such practices have been superseded by the less direct and more subtle measures of persuasion, propaganda, and bargaining.[2]

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[1] See the Harris Poll of September 1974 re the credibility of government, as reported in the Washington Post, September 30, 1974, p. A-6.

In some situations, the strength of the U.S. Government's position, as Whitman has pointed out,[3] depends largely upon the existence of assets in this country which can be seized or at least used as a weapon in bargaining. To the extent such assets do exist, the U.S. Government might make its role of "collector" known to foreign governments. In this way, the political risk facing U.S. exporters might be reduced.

Some foreign governments may, of course, not be influenced by the U.S. Government unless the U.S. Government itself participates in the provision of export credit. In this connection, many investors apparently feel that foreign governments are less apt to default on loans in which a government entity is participating, either directly

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[1] See Marina Whitman, Government Risk-Sharing in Foreign Investment (Princeton: Princeton University Press, 1965),pp. 40-41

[2] See Whitman, op. cit, pp. 42-45

[3] See Whitman, op. cit, pp. 44-45.

(through loans) or indirectly (through guarantees or insurance).[1] There are several reasons for this belief: The host country may believe that reprisals by the U.S. Government to be more likely, the host country may believe that the effect on its credit rating will be worse, and nationalistic hostility toward the foreign investment might be less.[2]

It is not clear that U.S. Government participation has in fact affected the behavior of foreign governments. If it has, a case could be made for such participation.

Whether or not Government participation affects foreign governments' behavior, it would reduce the political risk of private investors thru the sharing or spreading of such risk. This may well be the principal reason for investors' desire for government participation. On this basis, however, it is not clear that participation would be warranted.

A second way in which the government might reduce foreign distortions of the market is through the provision of information to foreign governments on the long-run adverse effects of some of their policies. If the provision of such information is a public good, and if such information would alter somewhat the behavior of foreign governments, an argument could be made for the U.S. government to undertake an educational campaign. The provision of such information to foreign governments is, in fact, a public good, since no individual exporter could capture all the benefits. Indeed, the benefits would be realized by all exporters. Whether the provision of such information would affect the behavior of foreign governments is a more difficult question to answer.

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[1] See Whitman, op. cit., p. 55.

[2] See Whitman, op. cit., pp. 55-56.

The U.S. Government has, in fact, sought to provide a favorable climate for U.S. foreign investors. Through diplomatic channels, developing countries have been continually reminded of the advantages from inward foreign investment.[1/]

Government policies designed to reduce foreign governments' distortions of the market -- through more efficient collection methods and provision of information to foreign governments -- will reduce the political risk in the provision of export credit. These policies will not, however, eliminate political risk, since the benefits may be limited and costs must be incurred to carry out such policies.

It has frequently been argued that political risk should be insured or guaranteed by the government, since commercial insurance is inherently incapable of dealing with it.[2/]

[1/] See Whitman, op. cit., p. 43.

[2/] See, for example, the comments by Marina Whitman in Whitman, op. cit, pp. 55-56.

It is true that, for two reasons, political risk is unlike many other forms of risk: first, the risks entailed are not likely to be independent; second, past experience is not likely to be adequate in providing precise actuarial tables on possible default.

Neither of these factors, however, preclude the possibility of commercial insurance. The lack of independence in possible outcomes does not mean that probabilities cannot be calculated; rather, it means that the probability distribution will not be normal. The resulting greater covariation of possible defaults will mean that the expected variance of possible outcomes will be greater than that entailed in a normal distribution. For this reason, the risk will be greater and the requisite premium higher than would be entailed with a normal distribution.

The fact that past experience is not likely to be adequate in providing precise actuarial tables on possible default also does not mean that probabilities cannot be calculated; rather, it means that the prior probabilities are held with less confidence than that entailed with some other forms of risk. This lack of confidence will mean that the expected variance in possible outcomes will be still greater. As a result, the risk will be even greater, and the requisite premium still higher.

The requisite premium for political risk might, in fact, be sufficiently large to preclude any effective demand by firms providing export credit. This absence of private insurance should not, however, be interpreted to mean that private insurance lacks the inherent ability to deal or cope with political risk. For this reason, it is not clear that government intervention in the form of guarantees or insurance is warranted against the residual political risk (the risk remaining after the correction for externalities). Certainly, a valid argument -- on the basis of correcting for a market failure -- cannot be made for the current Eximbank program of guarantees and insurance against all types of risk facing firms providing export credit.

Summary

Several arguments have been advanced to justify the subsidization of U.S. exports. The correction for market failures is clearly the most important one from the standpoint of the efficient use of resources. This argument has been regarded as the principal basis of the Eximbank's current program of subsidies for U.S. exports.

This paper has pointed out that the Eximbamk's current program of export subsidization cannot be supported on the basis of correcting for market failures. Indeed, although the market rate on loans to foreigners is typically considerably higher than that to domestic purchasers, the Eximbank frequently provides loans to foreigners at rates below that charged to domestic purchasers. In addition, there is little justification for the Eximbank to provide wide-ranging quarantees and rediscount facilities for commercial banks and wide-ranging insurance for exporters. This is not to say that market failures in the financing of U.S. exports do not exist. Rather, as this paper has pointed out, where market failures do exist, they argue for a more limited form of governmental intervention than is being carried out.

COMMITMENTS TO NUCLEAR POWER OUTSIDE U.S. JUMP 34% IN YEAR

(Report submitted by Atomic Energy Forum, Inc.)

NEW YORK, May 19, 1975--Thirty-eight countries, excluding the United States, have increased their nuclear power commitments 34% within the last year. Their total commitments to generate electricity with nuclear power rose from 221,000 Net MWe, as of second quarter, 1974, to 294,000 Net MWE, as of first quarter, 1975. (One MWe, or megawatt, equals 1,000 kilowatts.)

The second annual international nuclear reactor survey just completed by the Atomic Industrial Forum--the not-for-profit trade association of more than 625 manufacturers, utilities, consultants, uranium mining and milling companies, universities, labor unions, banks, and insurance companies--breaks down these total nuclear commitments as follows:

	1975		1974	
	Net MWe	**Reactors**	**Net MWe**	**Reactors**
Operable	29,175	102	24,293	96
Under construction	59,767	85	50,097	77
On order	54,462	70	56,112	73
Planned	150,874	169	90,073	102
Totals	294,278	426	220,575	348

The AIF survey, conducted in consultation with private and government utilities, manufacturers, and international energy authorities, reveals other significant facts about nuclear power plant commitments around the world:

1. Those countries already generating electricity with nuclear power all report that a kilowatt hour costs less to produce with nuclear power (including capital expenditure allocations) than with coal or oil--from 20-100% less.

2. By the end of the century, the 38 countries expect to produce from

13-85% of their electricity with nuclear power. The U.S. expects to produce about 50%.

3. This year, Switzerland is producing the largest percentage of electricity with nuclear power (17%) of any country. Belgium follows with 15%; the U.K., 10%; China (Taiwan), 9.6%, and Pakistan, 7%. The U.S. has capacity to produce nearly 8% of its electricity with nuclear power.

Country	Cost factor*			Forecast**	
		1975 MWe %	1980 MWe %	1990 MWe %	2000 MWe %
Argentina	–	319 (5.1)	919 (8.4)	6,719 (24)	–
Austria	20%	–	730 (5.6)	–	–
Belgium	50%	1,375 (15)	3,175 (25)	13,000 (60)	26,000 (60)
Brazil	–	–	630 (2.2)	10,200 (14.6)	–
Bulgaria	30%	440 (–)	1,760 (20)	5,760 (50)	13,000 (60)
Canada	–	2,513 (–)	6,000 (10)	35,000 (30)	100,000 (40)
China (Taiwan)	36%	636 (9.6)	3,242 (31.7)	–	–
Czechoslovakia	–	112 (–)	1,800 (7.5)	10,000 (25)	35,000 (–)
Denmark	–	–	–	4,900 (40)	11,400 (55)
Egypt	–	–	–	4,200 (–)	–
Finland	50%	–	2,160 (20)	–	8,000 (45)
France	50%	2,861 (–)	7,400 (25)	–	–
East Germany	–	520 (–)	–	–	–
West Germany	100%	3,500 (7)	20,000 (24)	120,000 (55)	200,000 (71)
Hong Kong	–	–	–	–	–
Hungary	–	–	–	–	–
India	–	580 (–)	1,240 (3)	8,620 (9.9)	–
Iran	–	–	1,200 (–)	–	–
Ireland	–	–	–	600 (10)	2,000 (20)
Israel	–	–	–	3,900 (40)	15,300 (67)
Italy	30%	1,500 (3.5)	5,500 (12)	47,000 (70)	125,000 (85)
Japan	35-40%	3,709 (–)	–	–	– (50)
Korea	25%	–	1,795 (20)	–	– (50)
Luxembourg	–	–	–	–	–
Mexico	–	–	1,308 (7)	14,800 (75)	–
Netherlands	–	535 (–)	3,500 (20)***	–	–
Pakistan	50%	125 (7)	725 (–)	5,800 (–)	15,000 (60)
Philippines	20%	–	–	3,200 (51.7)	7,800 (56.3)
Portugal	–	–	–	3,300 (37)	8,000 (47)
Rumania	–	–	–	–	20,000 (–)
South Africa	–	–	–	3,000 (8)	10,000 (13)
Spain	–	953 (–)	–	–	–
Sweden	–	1,260 (–)	8,260 (–)	23,600 (–)	–
Switzerland	–	1,006 (17)	3,700 (43)	8,000 (62)	–
Thailand	84%	–	–	1,200 (22)	2,400 (20)
U.K:	95%	7,000 (10)	11,000 (15)	43,000 (30)	150,000 (60)
U.S.S.R.	–	4,062 (–)	31,200 (–)	–	–
Yugoslavia	–	–	–	4,800 (80)	–

*Estimated savings in total cost of electricity produced by nuclear power, compared with coal or oil.

**Number of net megawatts planned to be produced by nuclear power, with the percentage of total electric generating capacity in parentheses.

***Figures for 1985.

The AIF survey also indicates that U.S.-type reactors--especially Light Water Reactors (LWR), including both Pressurized Water (PWR) and Boiling Water (BWR) reactors--continue to dominate nuclear power plant commitments outside the U.S. Of reactor types already chosen in the 38 countries, approximately 70% are U.S.-type LWRs.

Other significant information shown in the survey results:

The U.K. leads all countries outside the U.S. in total MWe of operable nuclear capacity. It can now generate 5,597 MWe with its 29 operable reactors. The U.S.S.R. follows with capacity for 4,062 MWe from 17 reactors. Then come Japan, 3,709 MWe (eight reactors); France, 2,861 MWe (10 reactors); Canada, 2,513 MWe (seven reactors); West Germany, 2,234 MWe (six reactors). The U.S. has 55 reactors, representing 37,496 MWe. It has another 63 under construction, representing 64,369 MWe, and 101 ordered, representing 113,736 MWe.

In total commitments to nuclear power--including plants operable, under construction, on order, or in some firm form of planning--France, Spain, and West Germany maintain their lead among countries outside the U.S. France has total nuclear commitments for 40,624 MWe (49 reactors); Spain, 33,241 MWe (36 reactors); West Germany, 26,704 MWe (29 reactors). Following these three countries are Japan, with total commitments for 19,792 MWe (30 reactors); the U.S.S.R., with 18,280 MWe (37 reactors); Czechoslovakia, 17,872 MWe (21 reactors); U.K., 15,787 MWe (44 reactors), and Iran, 12,200 MWe (12 reactors).

The sharply increased additions to nuclear plant commitments this year, according to the energy experts consulted, is mostly attributable to economic and political pressures caused by the Middle East oil situation.

Figures for the Eastern European countries in the attached AIF report are probably conservative; statistics from those countries are not as detailed as from others.

The report lists all known reactors of the 38 countries, including all available details on size, type, status, utility, location, and reactor supplier.

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Atomic Industrial Forum, Inc.
Public Affairs and
Information Program

NUCLEAR POWER PLANTS OUTSIDE THE U.S.

May 15, 1975

This list includes 426 commercial generating units representing 294,278 net megawatts (MWe) of 38 countries outside the U.S.: 102 operable reactors with a capacity of 29,175 MWe, 85 reactors under construction (59,767); 70 on order (54,462); and 169 in some stage of firm planning (150,874).

Reactors now operating are listed in bold-face type. Status of other reactors is indicated next to the plant name: (C) for those under construction; (O) for those on order; (P) for those planned.

Abbreviations used in the listing and not explained within it are:

AGR	Advanced gas cooled reactor
BLWR	CANDU boiling light water reactor
BWR	Boiling water reactor
CGR	Channel graphite reactor
FBR	Fast breeder reactor
GBWR	Graphite boiling water reactor
GCHWR	Gas cooled, heavy water moderated reactor
GCR	Gas cooled reactor
HTR	High temperature reactor
HWLWR	Heavy water moderated, boiling light water cooled reactor
LMFBR	Liquid metal fast breeder reactor
LWCHR	Light water cooled, heavy water moderated reactor
LWR	Light water reactor
PHWR	CANDU pressurized heavy water moderated and cooled reactor
PWR	Pressurized water reactor
AA	Aktiebolaget Asea-Atom (Sweden)
ACECO	Association des Ateliers de Charleroi et de Cockerill Ougree Providence (France)
AECL	Atomic Energy of Canada Limited (Canada)
AEE	Atomenergoexport (U.S.S.R.)

AEG	Allgemeine Elektricitaets-Gesellschaft (German Federal Republic)
AMN	Ansaldo Meccanico Nucleare SpA (Italy)
APC	Atomic Power Construction Ltd (U.K.)
BNDC	British Nuclear Design & Construction Ltd. (U.K.)
CEA	Commissariat a l'Energie Atomique (France)
CGE	Canadian General Electric Co. Ltd. (Canada)
EE	English Electric Company Ltd. (U.K.)
GA	General Atomic Company (U.S.A.)
GAAA	Groupement pour les Activities Atomique et Avancees (France)
GE	General Electric Company (U.S.A.)
GEC	General Electric Company (U.K.)
GETSCO	General Electric Technical Services Co. (Belgium)
INT	Interatom (German Federal Republic)
KWU	Kraftwerk Union (German Federal Republic)
MHI	Mitsubishi Heavy Industries Ltd. (Japan)
NERA	Neratoom NV (The Netherlands)
NNC	National Nuclear Corporation (U.K.)
SACM	Societe Alsacienne de Constructions Mechaniques (France)
TNPG	The Nuclear Power Group Ltd. (U.K.)
TW	Taylor Woodrow Construction Ltd. (U.K.)
W	Westinghouse Electric Corporation (U.S.A.)

Plant name and status	Type	Net MWe	Date Operable	Manufacturer	Location	Utility
ARGENTINA						
Atucha 1	**PHWR**	**319**	**9/74**	**Siemens**	**Lima, Buenos Aires**	**Comision Nacional de Energia Atomica**
Cordoba (C)	PHWR	600	2/80	AECL	Embalse, Rio Tercero Cordoba Province	same
Atucha 2 (P)	PHWR	600	'82	AECL	Lima, Buenos Aires	same
AUSTRIA						
Tullnerfeld 1 (C)	BWR	730	12/76	KWU/AEG	Vienna area	Gemeinschaftskernkraftwerk Tullnerfeld
Stein-St. Pantaleon 1 (P)	LWR	1,300	'81	–	Linz area	Gemeinschaftskernkraftwerk Stein
BELGIUM						
Doel 1	**PWR**	**390**	**10/74**	**W-ACEC-Cockerill**	**Antwerp**	**Centrale nucleaire Doel**
Doel 2 (C)	PWR	390	10/75	W-ACEC-Cockerill	same	same
* Tihange (C)	PWR	870	6/75	ACEC-Cockerill-Creusot Loire-Framatome	Huy-Liege	Societe Belgo-Francaise d'Energie Nucleaire Mosane (SEMO)
C.N. W 1 (O)	PWR	1,000	'81	W-ACEC-Cockerill	Zeebrugge or Nieuwpoort	–
C.N. W 2 (O)	PWR	1,000	'82	W-ACEC-Cockerill	same	–
Doel 3 (O)	PWR	900	'80	Framatome-ACEC-Cockerill	Antwerp	–
Tihange 2 (O)	PWR	900	'80	Framatome-ACEC-Cockerill	Huy-Liege	–

* Joint venture with France, which consumes additional 435 MWe from plant. Belgium consumes 47 MWe from reactor in Chooz, France, not included

Plant name and status	Type	Net MWe	Date Operable	Manufacturer	Location	Utility
BRAZIL						
Alm. Alvaro Alberto (Angra 1) (C)	PWR	626	3/77	W	Itaorna	Furnas–Centrais Eletricas SA
Angra 2 (P)	–	1,200	'82	–	same	same
Angra 3 (P)	–	1,200	'83	–	same	same
BULGARIA						
Kozlodui 1	**PWR**	**440**	**10/74**	**AEE**	**Kozlodui, north of Sofia**	**Electroenergetica**
Kozlodui 2 (C)	PWR	440	12/75	AEE	same	same
Kozlodui 3 (O)	PWR	440	'78	AEE	same	same
Kozlodui 4 (O)	PWR	440	'79	AEE	same	same
unnamed (P)	PWR	1,000	'90	AEE	–	same
unnamed (P)	PWR	1,000	'90	AEE	–	same
unnamed (P)	PWR	1,000	'90	AEE		same
unnamed (P)	PWR	1,000	'90	AEE	–	same
CANADA						
NDP	**PHWR**	**25**	**4/62**	**AECL**	**Rolphton, Ontario**	**–**
Douglas Point	**PHWR**	**206**	**9/68**	**AECL**	**Tiverton, Ontario**	**Ontario Hydro**
Pickering 1	**PHWR**	**508**	**7/71**	**AECL**	**Pickering, Ontario**	**same**
Pickering 2	**PHWR**	**508**	**12/71**	**AECL**	**same**	**same**
Pickering 3	**PHWR**	**508**	**6/72**	**AECL**	**same**	**same**
Pickering 4	**PHWR**	**508**	**6/73**	**AECL**	**same**	**same**
Gentilly 1	**BLWR**	**250**	**5/72**	**AECL**	**Gentilly, Quebec**	**Hydro Quebec**
Bruce 1 (C)	PHWR	732	10/77	AECL	Tiverton, Ontario	Ontario Hydro
Bruce 2 (C)	PHWR	732	12/76	AECL	same	same
Bruce 3 (C)	PHWR	732	12/78	AECL	same	same
Bruce 4 (C)	PHWR	732	12/79	AECL	same	same
Bruce 5 (O)	PHWR	732	'81	AECL	same	same
Bruce 6 (O)	PHWR	732	'82	AECL	same	same
Bruce 7 (O)	PHWR	732	'83	AECL	same	same
Bruce 8 (O)	PHWR	732	'84	AECL	same	same
Gentilly 2 (O)	PHWR	600	'79	AECL	Gentilly, Quebec	Hydro Quebec
New Brunswick 1 (O)	PHWR	600	'80	AECL	New Brunswick	–
Pickering 5 (O)	PHWR	508	'80	AECL	Pickering, Ontario	Ontario Hydro
Pickering 6 (O)	PHWR	508	'81	AECL	same	same
Pickering 7 (O)	PHWR	508	'81	AECL	same	same
Pickering 8 (O)	PHWR	508	'82	AECL	same	same
CHINA, REPUBLIC OF (TAIWAN)						
First Northern Nuclear Station 1 (C)	BWR	636	12/76	GE	Chin shan	Taiwan Power Co.
First Northern Nuclear Station 2 (C)	BWR	636	12/77	GE	same	same
Second Northern Nuclear Station 1 (O)	BWR	985	10/78	GE	same	same
Second Northern Nuclear Station 2 (O)	BWR	985	12/79	GE	same	same
Third Southern Nuclear Station 1 (O)	BWR	1,000	12/81	GE	Heng-chun	same
Third Southern Nuclear Station 2 (O)	BWR	1,000	12/82	GE	same	same
CZECHOSLOVAKIA						
Bohunice 1A	**GCHWR**	**112**	**'72**	**AEE**	**–**	**–**
Bohunice 2A (O)	PWR	440	'77	AEE	Jaslovske	–
Bohunice 2B (O)	PWR	440	'79	AEE	Bohunice	
Czechoslovakian 3 (O)	PWR	440	'79	AEE	Dukovany	–
Czechoslovakian 4 (O)	PWR	440	'80	AEE	same	–
unnamed (P)	–	1,000	'85	–	–	
unnamed (P)	–	1,000	'85		–	–
unnamed (P)	–	1,000	'90	–	–	–
unnamed (P)	–	1,000	'90	–	–	
unnamed (P)	–	1,000	'90		–	–
unnamed (P)	–	1,000	'90	–		–

Plant name and status	Type	Net MWe	Date Operable	Manufacturer	Location	Utility
CZECHOSLOVAKIA (cont'd)						
unnamed (P)	–	1,000	'90	–	–	–
unnamed (P)	–	1,000	'90	–	–	
DENMARK						
unnamed (P)	LWR	900	'82	–	Jutland peninsula	Elsam, Danish Utility Group
unnamed (P)	LWR	1,000	'90	–	Zealand	Kraftimport, Danish Utility Group
unnamed (P)	LWR	1,000	'90	–	same	same
unnamed (P)	LWR	1,000	'90	–	same	same
unnamed (P)	LWR	1,000	'90	–	same	same
EGYPT						
Egypt's First Atomic Power Plant (EFAPP) (P)	LWR	600	'81	-	Sidi Kreir (west of Alexandria)	Ministry of Electricity
FINLAND						
Loviisa 1 (C)	PWR	420	6/76	AEE	Loviisa	Imatran Voima Osakeyhtio
Loviisa 2 (C)	PWR	420	4/78	AEE	same	same
TVO 1 Olkiluoto (C)	BWR	660	8/78	AA	Olkiluoto	Teollisuuden Voima Osakeyhito
TVO 2 Olkiluoto (C)	BWR	660	8/80	AA	same	same
FRANCE						
Marcoule G2	**GCR**	**40**	**4/59**	**SACM**	**Marcoule**	**Electricite de France**
Marcoule G3	**GCR**	**40**	**11/60**	**SACM**	**same**	**same**
Chinon 2	**GCR**	**210**	**2/65**	**–**	**Chinon**	**same**
Chinon 3	**GCR**	**480**	**8/67**	**–**	**same**	**same**
Monts d'Arree EL-4	**GCHWR**	**73**	**10/67**	**CEA**	**Brennilis**	**same**
St. Laurent 1	**GCR**	**480**	**6/69**	**–**	**St. Laurent des Eaux**	**same**
St. Laurent 2	**GCR**	**515**	**8/71**	**–**	**same**	**same**
Phenix 250	**LMFBR**	**250**	**12/73**	**CEA/EdF/ GAAA**	**Marcoule**	**same**
Bugey 1	**GCR**	**540**	**4/72**	**–**	**Stvulbas (near Lyon)**	**same**
• **Chooz SENA**	**PWR**	**233**	**4/67**	**ACECO/ Framatome**	**Chooz**	**Societe d'Energie Nucleaire Franco—Belge des Ardennes (SENA)**
Fessenheim 1 (C)	PWR	890	4/76	Framatome	Fessenheim	Electricite de France
Fessenheim 2 (C)	PWR	890	7/76	Framatome	same	same
Bugey 2 (C)	PWR	925	12/76	Framatome	Stvulbas (near Lyon)	same
Bugey 3 (C)	PWR	925	8/77	Framatome	same	same
Bugey 4 (O)	PWR	905	5/78	Framatome	same	same
Bugey 5 (O)	PWR	905	12/78	Framatome	same	same
St. Laurent 3 (O)	BWR	970	'79	GE	St. Laurent des Eaux	same
St. Laurent 4 (O)	BWR	970	'80	GE	same	same
Dampierre 1 (O)	PWR	900	7/79	Framatome	Dampierre	same
Dampierre 2 (O)	PWR	900	1/80	Framatome	same	same
Tricastin 1 (O)	PWR	900	2/79	Framatome	Tricastin	same
Tricastin 2 (O)	PWR	900	8/79	Framatome	same	same
Tricastin 3 (O)	PWR	900	3/80	Framatome	same	same
Tricastin 4 (O)	PWR	900	11/80	Framatome	same	same
Gravelines 1 (O)	PWR	900	4/79	Framatome	near Dunkirk	same
Gravelines 2 (O)	PWR	900	10/79	Framatome	same	same
Gravelines 3 (O)	PWR	900	7/80	Framatome	same	same
Gravelines 4 (O)	PWR	900	4/81	Framatome	same	same
Blayais 1 (O)	PWR	900	7/80	Framatome	Bec d'Ambes near Bordeaux	same
Blayais 2 (O)	PWR	900	2/81	Framatome	same	same
Blayais 3 (P)	PWR	1,300	–	Framatome	same	same
Blayais 4 (P)	PWR	1,300	–	Framatome	same	same
Fessenheim 3 (P)	PWR	900	8/81	Framatome	Fessenheim	same
Fessenheim 4 (P)	PWR	900	6/82	Framatome	same	same
Dampierre 3 (P)	PWR	900	9/80	Framatome	Dampierre	same
Dampierre 4 (P)	PWR	900	6/81	Framatome	same	same
•• Creys-Malville (P)	Breeder	1,200	'80	–	Creys-Malville	same
Paluel 1 (P)	LWR	1,300	'81-'83	–	Paluel	same
Paluel 2 (P)	LWR	1,300	'81-'83	–	same	same
Paluel 3 (P)	LWR	1,300	'81-'83	–	same	same

Plant name and status	Type	Net MWe	Date Operable	Manufacturer	Location	Utility
FRANCE (cont'd)						
Paluel 4 (P)	LWR	1,300	'81-'83	–	same	same
Gravelines 5 (P)	PWR	1,300	–	Framatome	Gravelines (near Dunkirk)	same
Gravelines 6 (P)	PWR	1,300	–	Framatome	same	same
Port-la-Nouvelle 1 (P)	LWR	900	'81	–	Port-la-Nouvelle	same
Port-la-Nouvelle 2 (P)	LWR	900	'81	–	same	same
Port-la-Nouvelle 3 (P)	LWR	1,300	'81	–	same	same
Port-la-Nouvelle 4 (P)	LWR	1,300	'81	–	same	same
Chinon 4 (P)	LWR	–	'81	–	Chinon	same
Chinon 5 (P)	LWR	–	'82	–	same	same
GERMAN DEMOCRATIC REPUBLIC						
Rheinsberg 1	**PWR**	**80**	**5/66**	**AEE**	**Rheinsberg**	–
Nord 1-1	**PWR**	**440**	**12/73**	**AEE**	**Lubmin**	–
Nord 1-2 (C)	PWR	440	'75	AEE	–	–
Nord 2-1 (O)	PWR	440	'77	AEE	–	-
Nord 2-2 (O)	PWR	440	'78	AEE	–	–
GERMAN FEDERAL REPUBLIC						
Gundremmingen Block A	**BWR**	**250**	**12/66**	**AEG, GE**	**Gundremmingen**	**Kernkraftwerk-RWE-Bayernwerk GmbH (KRB)**
Lingen	**BWR**	**250**	**6/68**	**AEG**	**Lingen**	**Kernkraftwerk Lingen GmbH (Vereinigte Elektrizitatswerke Westfalen AG [VEW])**
Mehrzweckforschungsreaktor Karlsruhe	**PWR**	**57**	**'66**	**Siemens**	**Karlsruhe**	**GfK-Versuchsanlagen Kernkraftwerk Betriebsgesellschaft mbH (KBG)**
Obrigheim	**PWR**	**345**	**3/69**	**Siemens**	**Obrigheim**	**Kernkraftwerk Obrigheim GmbH (KWO)**
Stade	**PWR**	**662**	**5/72**	**Siemens**	**Stade**	**Kernkraftwerk Stade GmhH (Nordwestdeutsche Kraftwerke AG [NWK]; Hamburgische Electrizitatswerk [HEW])**
Wurgassen	**BWR**	**670**	**12/71**	**AEG**	**Wurgassen**	**Preussenelektra**
Biblis, Block A (C)	PWR	1,200	'74-'75	KWU	Biblis	Rheinisch-Westfaelisches Elektrizitaetswerk AG (RWE)
Biblis, Block B (C)	PWR	1,300	'76	KWU	same	same
Brunsbuttel (C)	BWR	805	'75	KWU	Brunsbuttel	HEW; NWK
Gemeinschaftskernkraftwerk Neckar (C)	PWR	805	'76	KWU	Neckarwestheim	Neckarwerke, TWS, DB
Grafenrheinfeld (C)	PWR	1,200	'79-'80	KWU	Grafenrheinfeld	Bayernwerk
Isar (C)	BWR	907	'76	KWU	Ohu	Bayernwerk, Isar-Amperwerke
Krummel (C)	BWR	1,316	'78	KWU	Krummel	HEW; Nordwestdeutsche Kraftwerke AG (NWK)
Philippsburg 1 (C)	BWR	900	'76	KWU	Philippsburg	Badenwerk; EVS
Philippsburg 2 (C)	BWR	907	'78	KWU	same	same
SNR 300, Kalkar (C)	HTR	300	'79	INB	Kalkar	Schnell Bruter-Kernkraftwerksgesellschaft (RWE, SEP, Synatom)
THTR-Prototype-Kernkraftwerk, Uentrop A (C)	HTR	310	'76	BBC/HRB	Uentrop-Schmehausen	HKG mbH
Unterweser (C)	PWR	1,300	'76	KWU	Esensham	NWK; Preussenelektra
Gundremmingen, Block B (O)	BWR	1,310	'79	KWU	Gundremmingen	KRB GmbH (RWE, Bayernwerk)
Gundremmingen, Block C (O)	BWR	1,310	'80	KWU	same	same
Kernkraftwerk Sud (O)	PWR	1,362	'79	KWU	Wyhl	Badenwerk, EVS
Mulheim-Karlich (O)	PWR	1,295	'78-'79	BBC/BBR	Mulheim-Karlich	RWE
Bad Breisig (P)	–	1,200	–	–	Bad Breisig	same
BASF Ludwigshafen (P)	PWR	750	–	–	Ludwigshafen	BASF
Brokdorf (P)	PWR	1,200	–	–	Brokdorf	NWK, HEW
Grobwelzheim (P)	PWR	1,200	–	–	Grobwelzheim	–
Grohnde (P)	PWR	1,200	–	KWU	Grohnde	Preussenelektra
Kernkraftwerk Sud (P)	PWR	1,200	–	–	Wyhl	Badenwerk; EVS
Lingen oder Schmehausen bei Uentrop (P)	–	1,200	–	–	Lingen oder Schmehausen	VEW
HONG KONG						
unnamed (P)	–	–	–	–	–	-

* An additional 142 MWe produced by this reactor are consumed in Belgium. Not included in this list are 120 MWe consumed in France by produced by Vandellos in Spain.

** Super Phenix. In collaboration with Germany and Italy.

Plant name and status	Type	Net MWe	Date Operable	Manufacturer	Location	Utility
HUNGARY						
Paks 1 (O)	PWR	440	'80	AEE	Paks	Hungarian Electrical Works
Paks 2 (O)	PWR	440	'80	AEE	same	same
INDIA						
Tarapur 1	**BWR**	**190**	**4/69**	**GE**	**Bombay**	**Atomic Energy Commission, Dept. of Atomic Energy (DAE)**
Tarapur 2	**BWR**	**190**	**4/69**	**GE**	**same**	**same**
Rajasthan 1	**PHWR**	**200**	**8/72**	**AECL**	**Kota, Rajasthan**	**same**
Rajasthan 2 (C)	PHWR	200	9/76	AECL	same	same
Kalpakkam 1 (O)	PHWR	220	3/77	DAE	Kalpakkam	same
Kalpakkam 2 (O)	PHWR	220	3/79	DAE	same	same
Narora 1 (O)	PHWR	220	3/81	DAE	Narora	same
Narora 2 (O)	PHWR	220	3/82	DAE	same	same
IRAN						
unnamed (O)	PWR	1,200	'80	KWU	Persian Gulf	–
unnamed (O)	PWR	1,200	'81	KWU	same	same
unnamed (O)	PWR	900	–	Framatome	–	–
unnamed (O)	PWR	900	–	Framatome	–	–
unnamed (P)	LWR	1,000	–	–	–	–
unnamed (P)	LWR	1,000	–	–	–	–
unnamed (P)	LWR	1,000	–	–	–	–
unnamed (P)	LWR	1,000	–	–	–	–
unnamed (P)	LWR	1,000	–	–	–	–
unnamed (P)	LWR	1,000	–	–	–	–
unnamed (P)	LWR	1,000	–	–	–	–
unnamed (P)	LWR	1,000	–	–	–	–
IRELAND						
Carnsore (P)	–	500-700	'83-'85	–	Co. Wexford	Electricity Supply Board
ISRAEL						
unnamed (P)	–	600	'82	–	Nitzanim	Israel Electric Co.
ITALY						
Latina	**GCR**	**160**	**1/64**	**TNPG**	**Borgo Sabotino**	**Ente Nazionale per l'Energia Electtrica (ENEL)**
Garigliano	**BWR**	**160**	**6/64**	**GE**	**Sessa Aurunca**	**same**
Trino Vercellese	**PWR**	**252**	**1/65**	**W**	**Vercelli**	**same**
Cirene (C)	LWCHR	40	'77	AMN	Latina	same
ENEL 4 (C)	BWR	840	4/75	AMN/GETSCO	Caorso	same
ENEL 5 (O)	PWR	952	'79	Elettronucleare Italiana	–	same
ENEL 6 (O)	BWR	982	'79	AMN	–	same
ENEL 7 (O)	PWR	1,000	'80	Elettronucleare Italiana	–	same
ENEL 8 (O)	BWR	1,000	'80	AMN	–	same
JAPAN						
Fukushima 1-1	**BWR**	**439**	**3/71**	**GE/Toshiba**	**Okuma, Fukushima**	**Tokyo Electric Power Co.**
Fukushima 1-2	**BWR**	**760**	**3/74**	**GE**	**same**	**same**
Shimane	**BWR**	**439**	**3/74**	**Hitachi**	**Kashima, Shimane**	**Chugoku Electric Power Co., Inc.**
Mihama 1	**PWR**	**320**	**11/70**	**W**	**Mihama, Fukui**	**Kansai Electric Power Co., Inc.**
Mihama 2	**PWR**	**470**	**7/72**	**MHI**	**same**	**same**
Tsuruga	**BWR**	**341**	**3/70**	**GE**	**Tsuruga, Fukui**	**Japan Atomic Power Co. Ltd.**
Tokai 1	**GCR**	**159**	**7/66**	**GEC**	**Tokai, Fukushima**	**same**
Takahama 1	**PWR**	**781**	**11/74**	**W**	**Takahama, Fukui**	**Kansai Electric Power Co., Inc.**
Tokai 2 (C)	BWR	1,080	10/76	GE	Tokai, Fukushima	Japan Atomic Power Co. Ltd.
Genkai 1 (C)	PWR	529	7/75	MHI	Genkai, Saga	Kyushu Electric Power Co., Inc.
Ohi 1 (C)	PWR	1,122	4/77	W	Ohi, Fukui	Kansai Electric Power Co., Inc
Ohi 2 (C)	PWR	1,120	10/77	W	same	same
Mihama 3 (C)	PWR	793	8/76	MHI	Mihama, Fukui	same
Takahama 2 (C)	PWR	781	7/75	MHI	Takahama, Fukui	same

Plant name and status	Type	Net MWe	Date Operable	Manufacturer	Location	Utility
JAPAN (cont'd)						
Fugen, ATR (C)	LWCHR	165	11/75	Hitachi/5 Group	Tsuruga, Fukui	Power Reactors & Nuclear Fuel Development Corp
Ikata (C)	PWR	538	4/77	MHI	Ikata, Ehime	Shikoku Electric Power Co.
Hamaoka 1 (C)	BWR	515	–	Toshiba	Hamaoka, Shizuoka	Chubu Electric Power Co.
Hamaoka 2 (C)	BWR	815	3/78	Toshiba/Hitachi	same	same
Fukushima 1-3 (C)	BWR	760	–	Toshiba	Okuma, Fukushima	Tokyo Electric Power Co.
Fukushima 1 4 (C)	BWR	760	8/76	Hitachi	same	same
Fukushima 1-5 (C)	BWR	760	12/75	Toshiba	Futaba, Fukushima	same
Fukushima 1-6 (C)	BWR	1,067	10/76	GE	Futaba, Fukushima, Fukui	same
Fukushima 11-1 (Tokyo 7) (C)	BWR	1,067	1/78	–	Naraha, Fukushima	same
Monju (O)	LMFBR	300	'78		–	Power Reactors & Nuclear Fuel Development Corp.
Onagawa 1 (O)	BWR	497	3/77	Toshiba	Onagawa, Miyagi	Tokyo Electric Power Co.
Hokuriku (Noto) (P)	–	500	12/77	–	Noto, Ishikawa	Hokuriku Electric Power Co.
Fukushima II 2 (Tokyo 8) (P)	LWR	1,067			Naraha, Fukushima	Tokyo Electric Power Co.
Hamaoka 3 (P)	–	750		–	Hamaoka, Shizuoka	Chubu Electric Power Co.
Genkai 2 (P)	PWR	559	11/79	-	Genkai, Saga	Kyushu Electric Power Co., Inc.
Ikata-2 (P)	PWR	538	7/79	–	Ikata, Ehime	Shikoku Electric Power Co., Inc.
KOREA, REPUBLIC OF SOUTH						
Ko-Ri 1 (C)	PWR	595	'76	W	Ko-Ri, near Pusan	Korea Electric Co.
Ko-Ri 2 (O)	PWR	600	'79	W	same	same
Chang-Yung 1 (P)	–	800	'82	–	Chang-Yung	same
Chang-Yung 2 (P)	–	800	'83	–	same	same
Nae Po 1 (P)	PHWR	600	'80	AECL	Nae-Po	same
Nae-Po 2 (P)	PHWR	600	'81	AECL	same	same
Power Reactor No. 7 (P)	–	800	'84	–	–	same
Power Reactor No. 8 (P)	–	800	'85	–	–	same
Power Reactor No. 9 (P)	–	800	'86	-	-	same
LUXEMBOURG						
unnamed (P)		1,200	–	–	Remerschen	Senu*

* Joint venture of the Luxembourg Government and the German RWE (Rheinisch-Westfaelisches Electrizitaetswerk).

Plant name and status	Type	Net MWe	Date Operable	Manufacturer	Location	Utility
MEXICO						
Laguna Verde Unit 1 (C)	BWR	654	7/77	GE	Laguna Verde, Veracruz	Comision Nacional de Energia Nuclear
Laguna Verde Unit 2 (C)	BWR	654	7/78	GE	same	same
THE NETHERLANDS						
Dodewaard	**BWR**	**58**	**3/69**	**GE/GKN**	**Dodewaard, Betuwe**	**Gemeenschappelijke Kernenergiecentrale Nederland NV (GKN)**
Borssele	**PWR**	**477**	**10/73**	**KWU**	**Borssele**	**NV Provinciale Zeeuwse Electriciteits Maatschappij**
unnamed (P)	–	1,000	'85	–	–	–
unnamed (P)	–	1,000	'85	–	–	–
unnamed (P)	–	1,000	'85	-	–	–
PAKISTAN						
Kanupp	**PHWR**	**125**	**10/72**	**CGE**	**Karachi**	**Pakistan Atomic Energy Commission**
Chashma Barrage N.P.P. (P)		600	'80-'81		Kundian	same
THE PHILLIPINES, REPUBLIC OF						
Bagac Nuclear Power Project (O)	PWR	600	'83	W	Luzon	National Power Corporation
Bagac Nuclear Power Project (O)	PWR	600	'84	W	same	same
Bagac Nuclear Power Project (P)		800	'95	–	same	same
Bagac Nuclear Power Project (P)	–	800	'97	–	same	same
San Juan Nuclear Power Project (P)		800	'91	-	same	same
San Juan Nuclear Power Project (P)	–	800	'93		same	same
Ternate Nuclear Power Project (P)	–	600	'88		same	same
Ternate Nuclear Power Project (P)	–	600	'90		same	same

Plant name and status	Type	Net MWe	Date Operable	Manufacturer	Location	Utility
PAKISTAN (cont'd)						
Ternate Nuclear Power Project (P)	-	1,100	'99	–	same	same
Ternate Nuclear Power Project (P)	–	1,100	2000	–	same	same
PORTUGAL						
unnamed (P)	LWR	600-1,000	'81	–	Atlantic Coast, north of Lisbon	Companhia Portuguesa de Electricidade (CPE)
unnamed (P)	LWR	680	'83	–	–	–
unnamed (P)	LWR	980	'85	–	–	–
unnamed (P)	LWR	980	'88	–	–	–
RUMANIA						
Olt (O)	PWR	440	'80s	-	west of Bucharest	–
SOUTH AFRICA, REPUBLIC OF						
Koeberg 1 (P)	LWR	950	'82	·	near Cape Town	Electricity Supply Commission
Koeberg 2 (P)	LWR	950	'83-'84	–	same	same
SPAIN						
Santa Maria de Garona	**BWR**	**440**	**3/71**	**GE**	**Santa Maria de Garona, Burgos**	**Centrales Nucleares del Norte, S.A.**
Vandellos	**GCR**	**360**	**5/72**	**GC**	**Tarragona**	**Hispano Francesa de Energia Nuclear, SA**
Jose Cabrera	**PWR**	**153**	**8/68**	**W**	**Zorita-Guadalajara**	**Union Electrica, S.A. (UE)**
Asco 1 (C)	PWR	900	7/77	W	Asco, Tarragona	Fuerzas Electricas de Cataluna, S.A. (FECSA)
Asco 2 (C)	PWR	900	12/78	W	same	same
Almaraz 1 (C)	PWR	902	12/76	W	Almaraz, Caceres	Hidroelectrica Espanola, S.A.
Almaraz 2 (C)	PWR	902	12/77	W	same	same
Confrontes (C)	BWR	930	'78	GE	Confrontes, Valencia	same
Lemoniz 1 (C)	PWR	902	12/76	W	Lemoniz, Vizcaya	Iberduero S.A.
Lemoniz 2 (C)	PWR	902	7/78	W	same	same
Ametlla de Mar 1 (P)	–	1,000	'81	–	Amartlla de Mar, Tarragona	FECSA
Ametlla de Mar 2 (P)	–	1,000	'84	–	same	same
Aragon 1 (P)	–	1,200	'81	–	Aragon, Zaragoza	FECSA; Electricas Reunidas de Zaragoza, Energia e Industrias Aragonesas; UE
Aragon 2 (P)	–	1,200	–	–	same	same
Asperillo 1 (P)	–	1,000	'90	–	Almonte, Huelva	Compania Sevillana de Electricidad
Asperillo 2 (P)	–	1,000	'92	–	same	same
Cabo Cope (P)	–	1,000	'79	–	Cabo Cope, Murcia	Hidroelectrica Espanola
Escatron 1 (P)	–	1,000	'82	–	Escatron, Zaragoza	Empresa Nacional de Electricidad; Empresa Nacional Hidroelectrica Ribagorzana
Escatron 2 (P)	–	1,000	'85	-	same	same
Oguella 1 (P)	–	1,000	'88	-	Oguella, Vizcaya	Iberduero S.A.
Oguella 2 (P)	–	1,000	'89	–	same	same
Punta Endata 1 (P)	–	1,000	'79	–	Punta Endata, Guipuzc	same
Punta Endata 2 (P)	–	1,000	'81	–	same	same
Regodola (P)	–	900	'82	–	Regodola, Lugo	Fenosa Electra de Viesgo Hidroelectrica del Cantabrico
Santillan 1 (P)	–	900	'79	–	Santillan, Santander	Electra de Viesgo
Santillan 2 (P)	–	900	'87	–	same	same
Sayago (P)	–	1,000	'82	–	Sayago, Zamora	Iberduero S.A.
Tarifa 1 (P)	–	1,000	'79	–	Tarifa, Cadiz	Compania Sevillana de Electricidad
Tarifa 2 (P)	–	1,000	'82	–	same	same
Trillo 1 (P)	–	1,000	'81	–	Trillo, Guadalajara	UE
Trillo 2 (P)	–	1,000	'86	–	same	same
Valdecaballeros 1 (P)	–	1,000	'82	–	Valdecaballeros, Badajoz	–
Valdecaballeros 2 (P)	–	1,000	'82		same	–
Vandellos C (P)	–	925	'81	–	Falset, Tarragona	FECSA
Vandellos F (P)	–	925	'81		same	same
Vergara (P)		1,000	'86	–	Vergara, Navarra	Iberduero S.A.
SWEDEN						
Oskarshamn 1	**BWR**	**440**	**'72**	**AA**	**Oskarshamn**	**Oskarshamnsverkets Kraftgrupp AB (OKG)**
Oskarshamn 2	**BWR**	**580**	**'74**	**AA**	**same**	**same**
Ringhals 1	**BWR**	**760**	**'74**	**AA**	**Varberg**	**Statens Vattenfallswerk (SSPB)**

Plant name and status	Type	Net MWe	Date Operable	Manufacturer	Location	Utility
SWEDEN (cont'd)						
Ringhals 2	PWR	820	'74	W	same	same
Ringhals 3 (C)	PWR	915	'77	W	same	same
Ringhals 4 (C)	PWR	915	'79	W	same	same
Barseback 1 (C)	BWR	580	'75	AA	Malmo	Sydsvenska Kraftaktiebolaget
Barseback 2 (C)	BWR	580	'76	AA	same	same
Forsmark 1 (C)	BWR	900	'78	AA	Gavle	SSPB
Forsmark 2 (C)	BWR	900	'80	AA	same	same
Oakarshamn 3 (P)	BWR	900	'81	–	Oskarshamn	OKG
SWITZERLAND						
Beznau 1	PWR	350	12/69	W	Doettingen	Nordostschweizerische Kraftwerke AG (NOK)
Beznau 2	PWR	350	3/72	W	same	same
Muhleberg	BWR	306	10/72	GETSCO	Muhleberg	Bernische Kraftwerk AG
Goesgen (C)	PWR	920	12/77	KWU	Daeniken	Kernkraftwerk Goesgen-Daeniken AG (KKG)
Graben (O)	BWR	1,140	'80	–	Graben	Bernische Kraftwerke AG
Kaiseraugst (O)	BWR	924	12/79	GETSCO	Kaiseraugst	Kernkraftwerk Kaiseraugst AG (KKK)
Leibstadt (O)	BWR	940	12/78	GETSCO	Leibstadt	Kernkraftwerk Leibstadt AG (KKL)
Ruethi (P)	–	900	'80	–	Ruethi	NOK
Verbois (P)	–	1,000	'80	–	Russin	–
THAILAND						
Ao Phai (P)	LWR	600	'82	–	Sriracha	Electricity Generating Authority of Thailand
Ao Phai (P)	LWR	600	'85	–	same	same
unnamed (P)	–	600	'91	–	–	same
unnamed (P)	–	600	'96	–	–	same
UNION OF SOVIET SOCIALIST REPUBLICS						
Novo-Voronezh 1	PWR	265	'64	–	near Voronezh	Ministry of Electric Power
Novo-Voronezh 2	PWR	365	'69	–	same	same
Novo-Voronezh 3	PWR	440	'71	–	same	same
Novo-Voronezh 4	PWR	440	'72	–	same	same
Beloyarsk 1	GBWR	100	'64	–	near Sverdlovsk	same
Beloyarsk 2	GBWR	200	'68	–	same	same
Shevchenko	FBR	150	'72	–	near Astrakhan	State Committee on Atomic Energy
Kola 1	PWR	440	'73	–	near Murmansk	Ministry of Electric Power
Troitsk 1	CGR	100	'58	–	Siberia	same
Troitsk 2	CGR	100	'58	–	same	same
Troitsk 3	CGR	100	'58	–	same	same
Troitsk 4	CGR	100	'58	–	same	same
Troitsk 5	CGR	100	'58	–	same	same
Troitsk 6	CGR	100	'58	–	same	same
Novomelekess 1	BWR	50	'62	–	near Ulyanovsk	Scientific Research Institute for Atomic Reactors
Novomelekess 2	FBR	12	'69	–	same	same
Leningrad 1	CGR	1,000	11/74	–	near Leningrad	Ministry of Electric Power
Bilibino 1 (C)	BWR	12	–	–	north of East Siberia	same
Bilibino 2 (C)	BWR	12	–	–	same	same
Bilibino 3 (C)	BWR	12	–	–	same	same
Bilibino 4 (C)	BWR	12	–	–	same	same
Beloyarsk 3 (C)	FBR	600	'75	–	near Sverdlovsk	Ministry of Electric Power
Oktemberyan 1 (C)	PWR	440	–	–	west of Yerevan, Armenia	same
Oktemberyan 2 (P)	PWR	440	–	–	same	same
Leningrad 2 (P)	CGR	1,000	–	–	near Leningrad	same
Novo-Voronezh 5 (P)	PWR	1,000	–	–	near Voronezh	same
West Ukraine (P)	PWR	1,000	–	–	–	same
Kola 2 (P)	PWR	440	–	–	near Murmansk	same
Western 1 (P)	CGR	1,000	–	–	–	same
Western 2 (P)	CGR	1,000	–	–	–	same
Chernobyl 1 (P)	CGR	1,000	–	–	near Kiev	same
Chernobyl 2 (P)	CGR	1,000	–	–	same	same
Smolensk 1 (P)	CGR	1,000	–	–	–	same
Smolensk 2 (P)	CGR	1,000	–	–	–	same
Kursk 1 (P)	CGR	1,000	'77	–	–	same

Plant name and status	Type	Net MWe	Date Operable	Manufacturer	Location	Utility
UNION OF SOVIET SOCIALIST REPUBLICS (cont'd)						
Kursk 2 (P)	CGR	1,000	'77	–	–	same
unnamed (O)*	PWR	1,250	'80	Preusseneletra	Kaliningrad	–
UNITED KINGDOM						
Dounreay PFR	LMFBR	250	3/74	AEA/TNPG	Caithness	United Kingdom Atomic Energy Authority (UKAEA)
Winfrith SGHWR	HWLWR	100	12/67	UKAEA	Dorset	same
Windscale	AGR	34	10/62	UKAEA	Cumbria	same
Chapel Cross 1	GCR	50	11/58	UKAEA	Dumfriesshire	British Nuclear Fuels Limited
Chapel Cross 2	GCR	50	1/59	UKAEA	same	same
Chapel Cross 3	GCR	50	3/59	UKAEA	same	same
Chapel Cross 4	GCR	50	4/59	UKAEA	same	same
Calder Hall 1	GCR	52	9/56	UKAEA	Cumbria	same
Calder Hall 2	GCR	52	9/56	UKAEA	same	same
Calder Hall 3	GCR	52	1/58	UKAEA	same	same
Calder Hall 4	GCR	52	1/58	UKAEA	same	same
Hunterston A-1	GCR	160	5/64	GEC	Ayrshire	South of Scotland Electricity Board
Hunterston A-2	GCR	160	9/64	GEC	same	same
Berkeley 1	GCR	137.5	6/62	TNPG	Gloucestershire	Central Electricity Generating Board (CEGB)
Berkeley 2	GCR	137.5	10/62	TNPG	same	same
Bradwell 1	GCR	150	6/62	TNPG	Essex	same
Bradwell 2	GCR	150	11/62	TNPG	same	same
Trawsfynydd 1	GCR	250	2/65	APC	Wales	same
Trawsfynydd 2	GCR	250	3/65	APC	same	same
Dungeness A-1	GCR	275	9/65	TNPG	Kent	same
Dungeness A-2	GCR	275	12/65	TNPG	same	same
Sizewell A-1	GCR	290	1/66	EE/BW/TW	Suffolk	same
Sizewell A-2	GCR	290	3/66	EE/BW/TW	same	same
Hinkley Point A-1	GCR	250	5/65	EE/BW/TW	Somerset	same
Hinkley Point A-2	GCR	250	5/65	EE/BW/TW	same	same
Oldbury 1	GCR	300	11/67	TNPG	Gloucestershire	same
Oldbury 2	GCR	300	11/67	TNPG	same	same
Wylfa 1	GCR	590	1/71	EE/BW/TW	Wales	same
Wylfa 2	GCR	590	4/71	EE/BW/TW	same	same
Hartlepool 1 (C)	AGR	625	6/78	BNDC	Durham	same
Hartlepool 2 (C)	AGR	625	12/78	BNDC	same	same
Dungeness B-1 (C)	AGR	600	4/76	APC	Kent	same
Dungeness B-2 (C)	AGR	600	9/76	APC	same	same
Hinkley Point B-1 (C)	AGR	625	6/75	TNPG	Somerset	same
Hinkley Point B-2 (C)	AGR	625	3/75	TNPG	same	same
Heysham 1 (C)	AGR	625	5/78	BNDC	Lancashire	same
Heysham 2 (C)	AGR	625	11/78	BNDC	same	same
Hunterston B-1 (C)	AGR	625	3/75	TNPG	Ayrshire	South of Scotland Electricity Board
Hunterston B-2 (C)	AGR	625	5/75	TNPG	same	same
CFR (P)	FBR	1,300	–	–	–	–
Sizewell B1 (P)	SGHWR	660	–	NNC	Suffolk	Central Electricity Generating Board
Sizewell B2 (P)	SGHWR	660	–	NNC	same	same
Sizewell B3 (P)	SGHWR	660	–	NNC	same	same
Sizewell B4 (P)	SGHWR	660	–	NNC	same	same
YUGOSLAVIA						
NE Krsko (C)	PWR	632	2/79	W	Krsko	Savske Electrane (Slovenia); Elektroprivreda (Croatia)

* Reactor will be built by West Germany in exchange for part of electricity generated.

SAFEGUARDS—THE INDUSTRY'S ROLE AND VIEWS

(Speech by Carl Walske, President, Atomic Industrial Forum, Inc.)

The U.S. nuclear industry, or nuclear energy community—whatever we may call it—consists of hundreds of companies and other organizations interested in commercial applications of nuclear energy. Most, if not all, of them are members of the Atomic Industrial Forum—some 625 as of today. Their opinions naturally vary on any issue which affects the development of nuclear energy, though oftentimes there is a general consensus view. So it is with the matter of safeguarding nuclear material of weapons grade—or special nuclear material.

While the Forum has not polled its membership on safeguards questions we on the staff have had a number of discussions with a good sample of responsible people from our member organizations. These include people from fuel reprocessors and fabricators, utilities, reactor manufacturers and transportation companies. On the basis of these discussions I have some feeling for what "the industry" is thinking about safeguards. As I talk I shall also mix in my own views, identifying them where they may be special to my own experience.

First of all, the industry is proud of the record to date. There have been no diversions. There has been no sabotage. There have been a few cranks, or other malicious persons, who have made threats. Most of these, unfortunately, probably were inspired by the publicity which has been given the subject. In the view of many of us, the publicity was unfortunate, but that's water over the dam now and we have to deal with the situation as it is.

I said that the record to date is perfect and that's true. Of course, the quantities of plutonium and highly enriched uranium handled in the industry have been miniscule by comparison with what lies ahead as we move toward the eighties. The industry knows this and fully appreciates that strengthened controls are necessary to deal with the large amounts of special nuclear materials which we anticipate.

Now, is it possible to protect special nuclear material sufficiently so that reasonable people will agree that any risk from diversion or sabotage is negligible? I believe that it is and at a cost which, although high, need not be so high as to cripple the economics of nuclear power.

The current safeguards system, as spelled out in new AEC regulations, is a clearly strengthened one as compared to what we had just a year ago. I believe it goes a long way towards what we need. At the same time there are certain aspects of this safeguards system which can be further improved. Some are appropriate to the industry's area of responsibility, some to the government's area. The balance of this paper discusses these possible improvements. They are, I believe, supported generally by the nuclear industry.

I shall be talking about the security personnel with the special nuclear material, physical protection, accounting and monitoring of special nuclear material in plants, communications, the command function, reinforcements and intelligence information. All these are necessary and complementary in building a first-class protective system for anything—whether it's gold bullion or special nuclear materials. They are necessary for special nuclear material at a fixed installation or in transit.

Guard forces and physical protection with special nuclear material can provide a first line of defense. It is not necessary that this line be impregnable, provided it is backed up with a reliable communications system which can be used to call up adequate reinforcements from a friendly command. Accounting for and monitoring of special nuclear material, ideally on a current basis, can signal departures from normal conditions, that is, sound a warning that something has gone wrong. Intelligence information, when available, is even better; it can signal in advance that something is about to go wrong.

Let's talk now about guard forces. First of all, most people in the industry would prefer to manage their own, other things being equal, but there is a problem. AEC regulations call for the use of armed force, if necessary, to prevent diversion or sabotage of special nuclear materials. In my own view this is appropriate, but in the civilian nuclear industry it is essentially unprecedented. It brings with it a responsibility beyond the experience of most commercial organizations and one which threatens with a morass of legal liabilities. However, there is a compromise on the question of who should provide and manage guard forces. The compromise approach is to divide functions between those requiring the use of armed forces and all others. The former should be performed by governmental forces; the latter by security personnel directed by the company responsible for the special nuclear material.

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For example, at fixed installations, monitoring and searching, if necessary, of plant personnel; materials accounting and monitoring; and maintenance and testing of physical security systems can all be done perfectly well by personnel under the plant management. In fact, they can be done with less upset to plant operations and to plant personnel—insiders dealing with insiders.

However, should the situation call for the use, or threatened use, of firearms to deal with a security problem—attempted diversion or sabotage—properly authorized public law enforcement forces should be brought into play. Such forces may be stationed at or near the fixed installation, or they may be on call from their normal station nearby. Obviously, they must be in a position where they can provide a timely reaction. For most fixed installations local police units may prove to be the most satisfactory.

Guards accompanying special nuclear material in transit must be able to meet force with force. Local police forces, in general, will not be able to respond rapidly enough to deal with attempted diversion and sabotage. Largely for this reason many in the industry feel that such guards must be under governmental control and must be authorized to act in emergencies under governmental orders. This might be done by using a special, governmentally organized force, or by civilian guards under contract to the government.

In all cases—material at fixed installations or in transit—guard forces should be well trained and required to exceed minimum physical and mental qualifications. They should be requalified by government inspectors on a periodic basis. Most importantly, guards should be given clearly defined authorities to govern their actions in the various emergency situations that could arise.

Physical protection of special nuclear material may include fences, lighting, vaults, and detection and alarm systems at fixed installations; and for material in transit it may include heavy containers or armored vehicles. These complement the assigned guard personnel. In general, the industry has accepted and agreed with AEC requirements for physical protection. There should, however, be a continuing review of these requirements, on the one hand, to see that no "Achilles' heels" are left in the protection systems and, on the other hand, to eliminate costly features which make only marginal additions to security.

AEC regulations currently permit shipment of special nuclear material—as defined in 10 CFR Part 73—either in a conventional truck with an armed escort vehicle manned by two armed guards, or in a specially designed truck or trailer without an armed escort. The design of such a special truck or trailer must include a capability for immobilization of the vehicle and must provide armor and other deterents to physical penetration. In a properly designed overall protective system the deterence to physical penetration will allow sufficient time for reinforcements to arrive at the scene of a diversion attempt.

In general, the industry is sympathetic with the armored vehicle approach when it is applied to special nuclear materials in a sensitive form suited to easy movement and direct usage in nuclear explosives, that is, separated highly enriched uranium or plutonium in the metallic or oxide form. However, when either of these fuels is contained in a fabricated fuel element, they are awkward to transport and they must be separated chemically or physically in order to be used as ingredients in a nuclear explosive. Thus, the industry's feeling is that for truck shipments of separated or concentrated special nuclear material, we should phase over, as practical, to the use of the armored vehicles. Until this is achieved and while conventional trucks are still in use, I believe that more than one armed escort vehicle should accompany shipments and each escort vehicle should have at least two armed guards.

Shipments by air, where possible, can generally be made the most secure I noticed recently that the JCAE's Conway Committee has recommended against plutonium shipments by air, except in cases involving national security. This appears to me to be unfortunate. The risk of extensive aerial dispersion in a plane crash is certainly minimal. Careful choice of flight paths and special packaging could reduce even this small risk. It seems to me wrong to give up our most secure means of transporting plutonium.

Shipments abroad of special nuclear material must provide for adequate protection until a shipment is safely in the hands of its intended recipient. It goes without saying that precautions must be taken against hijacking and also that recipients must be capable of protecting material in their custody.

Reliable personnel are an absolute must if we are to have good security. Although security-type clearances are foreign to the civilian industry, nevertheless a clearance program appears appropriate. It would apply to all personnel having access to significant quantities of special nuclear materials. The AEC has now obtained legislation necessary for such a program. I believe the industry, in general, understands the need for this and supports it.

Such personnel clearances should certainly reduce the concern of those—such as the author of the Rosenbaum report—who postulate that "insiders", including senior management and operating personnel working within a facility or transportation company, could be involved in sabotage or diversion.

Furthermore, such cleared employees of licensees need be searched only exceptionally on entering or leaving protected areas containing special nuclear materials. Monitoring with instruments should suffice, with spot check searches only infrequently. As I said earlier, any such physical monitoring or searching should be the responsibility of personnel employed by the plant management.

At the same time I must say that security-type clearances are not to be taken lightly. It is most important that our society carefully preserve the rights of its members. Security clearances can obviously be abused. It will be up to all of us to guard vigilantly against any such abuse.

Much effort and much expense have gone into accounting and monitoring systems for special nuclear materials "in process" in a plant. Presently available techniques suffer from two great faults: First, their accuracy is such as to leave sizeable quantities of special nuclear material in a doubtful status; and, second, they report on losses only after they have happened, not as they are happening. All the same, the industry generally supports the rational application of the present techniques. There is, however, a strong feeling that it is illogical to incur greatly increased costs by shutting down plants frequently for overall inventories and by reducing allowed inaccuracies beyond what is straightforward. Unfortunately, the answers from the present system will be inaccurate, whatever the effort expended. Therefore it is sensible to use the present system only for what it is capable of doing—that is, detecting gross losses or diversions.

Beyond the present system, we may hope to have real time and accurate accounting someday. I don't know how achievable this may be, but it is certainly the right objective. Even now we can use special precautions whenever there are inter-area transfers at a plant. These could include independent weighings, checks of seal integrity, and other routine accounting actions and measuring actions to aid in the prompt detection of diversion.

Let us turn now to the question of communication systems. As I said earlier such systems serve the purpose of permitting local guard forces at a fixed installation or with a shipment to call for assistance, that is, to call for reinforcements. Obviously, such a purpose will only be met if the communications are highly reliable and if reinforcement forces are available for timely reaction from authorities having such forces at their disposal.

The AEC presently requires a licensee to maintain communications between his so-called control point and the guard forces at his installation or with shipments containing special nuclear materials. Carriers must make advance arrangements to assure support from law enforcement agencies. For shipments the present system relies on (1) the use of radio-telephones which are not effective in large areas of the United States, although they are working well in present operating areas; (2) local or state law enforcement agencies for reinforcements; and (3) support arrangements as can be made between such law enforcement agencies and the licensee.

There are several important improvements that should be made to the present system. First, the communications should be based on a federally operated, high frequency network. Such a network has proven highly reliable in maintaining radio contact with virtually all areas of the U.S. Second, a federal command center, perhaps supported by regional centers. should be established. It would receive and act promptly on reports of attempted diversion or sabotage involving special nuclear materials. Such a communications system and command center would be for both fixed installations and shipments.

The federal agency responsible for operating the federal command center should be responsible for consummating agreements with local and state police, the national guard and federal armed forces for provision of reinforcements. As mentioned previously, effective local law enforcement agencies are particularly well suited for responding rapidly to incidents at fixed facilities. Generally, state and federal forces will be more effective for incidents affecting material in transit. The agreements will certainly involve state governors for state police and the national guard; they will involve the President for federal armed forces. New legislation may be necessary to implement these arrangements. It is my impression that this area of federal communications, a federal command center and authority and implementing agreements, is the single most important task facing us as we move to improve the protective system. You will note that this, as I have presented it, is a task requiring the initiative and leadership of the federal government.

A special type of reinforcement capability would be needed if a diversion attempt were to prove successful, that is, if a diverter were to escape the first line of defense. In this event retrieval of the special nuclear material would be our objective. A retrieval operation would logically use nationwide intelligence information and therefore would best be handled by using a federal force under federal direction. This might be basically an FBI operation under the Attorney General.

Intelligence information available to the FBI, Treasury Department, CIA, Department of Defense, AEC, and state and local law enforcement agencies will never be sufficient to forecast all threats that may be developing. However, the totality of information available to these agencies can be very helpful in reducing risks. It is not clear to me that a good mechanism now exists for the prompt reporting of such information to a central, responsible command authority of the type previously mentioned and, also, the prompt dessemination of such information to law enforcement agencies. If it is not being done well, as I suspect, it should be corrected.

I have discussed a number of improvements that would strengthen our present safeguards system. The major new tasks are in the area of governmental responsibility, although I have mentioned some additional tasks for the industry. These would not, in my view, involve an appreciable increase in present safeguards costs. In fact, the AEC's new regulations—in effect since December 6, 1973, and now being implemented—went a long way to provide the necessary measures required of the industry.

As we look on ahead to the future, the nuclear industry will continue to work with the AEC to employ more stringent methods and procedures. Safeguards cannot be static as the nature of the problem changes. Both industry and government must move forward together to meet their vital responsibilities in this area.

My main points in this paper, aimed at strengthening our safeguards system are, I believe, generally acceptable to the nuclear industry. These points are:

1. Local guard forces and physical security measures should be sufficient to detect, report and delay attempted sabotage or diversion until reinforcements arrive.
2. Guard and security forces at fixed installations should be under the supervision of the plant management, except for those guards charged with the use of armed force. These last should be governmental forces, or at least governmentally organized and supervised guards.
3. Guards accompanying special nuclear material in transit should be under governmental control and should be authorized to act under governmental orders in emergencies. They may, thus, be government employees or contract guards under government orders.
4. Moreover the federal government should be directly and fully responsible for security of special nuclear materials in transit, coordinating and making use of local, state and federal resources.
5. For shipments of concentrated special nuclear material phasing over of conventional truck transportation should be undertaken, as practical, to the use of armored vehicles with immobilizing features. The design of the transport vehicle should include a strong barrier against penetration, which will allow sufficient time for reinforcements to arrive.
6. Physical protective features for special nuclear materials should complement guard forces in such a way that no "Achilles' heels" are left, but also so that costly features providing marginal additions to security are eliminated.
7. Agreements should be consummated, as necessary, between the responsible federal agency and local, state and federal officials for the prompt use of their forces when necessary. These agreements should include arrangements for operations by a federal retrieval force and for exchanging threat information with law enforcement and other agencies.
8. A federal communication system and command center should be created to support and coordinate the response of local, state and federal security forces in the event of attempted sabotage or diversion attempts at fixed installations or during transport.
9. Improved real time accounting procedures should be developed and implemented, at which time the dependence on MUF and LEMUF for detection of diversion should be greatly reduced.
10. An employee clearance program should be established for licensee personnel who have accesss to significant quantities of special nuclear material.

I regret that adequate safeguards require so much government involvement, particularly by the federal government. It would certainly be preferable if the industry could handle this problem entirely "in-house". Unfortunately, that does not seem to be a practical way to reach our objective of providing proper protection to special nuclear materials. We must, it appears, proceed with an industry-government partnership with each carrying out its role where it can do the best job.

In conclusion, I want to re-emphasize that the nuclear industry recognizes the importance of protecting nuclear facilities and special nuclear materials at fixed sites and in transit. We are confident that potential risks will be held at such a low level that they will be acceptable in the judgment of reasonable people.

NUCLEAR SAFEGUARDS—A PERSPECTIVE

(Speech by Carl Walske, President, Atomic Industrial Forum, Inc., New York City)

Today I want to share with you a few thoughts on nuclear safeguards, both for application internationally and domestically. Certainly the subject has never been "hotter" than it is at present. Those of us who believe in nuclear power, and who are convinced that it is dearly needed to help solve the energy crisis in the U.S. and abroad, are at the same time aware of the need to provide good answers to the questions which are being raised.

The term safeguards has been applied to two related, but quite different situations: first, to measures taken to assure that sovereign nations are not diverting special nuclear material in order to achieve a nuclear weapons capability; and, second, to measures taken by national authorities to assure that special nuclear materials are not stolen by criminal elements or terrorists for use in threats or actual violence against others. The similarities in the two cases include the nature of the material protected and some of the means used for protecting it. Accounting and auditing of special nuclear material is used in both cases. Physical protection is particularly important against criminal elements. The two cases are very dissimilar as regards the role played by the governments of the countries in which the safeguards are applied. Because of this I believe it is helpful to classify the two safeguards cases with a descriptive adjective, referring to the one as "anti-criminal safeguards" and to the other as "proliferation safeguards."

The non-proliferation of nuclear weapons is a fairly well accepted international objective, or perhaps I should say instead the halt of further proliferation, since at least six nations now have a nuclear weapons capability. Most states, whether nuclear weapons states or not, see the further proliferation of nuclear weapons as increasing the number of opportunities for confrontations involving nuclear weapons and, hence, increasing the probability of nuclear conflict. There is, of course, great concern that any nuclear conflict might rapidly escalate into widespread use of nuclear weapons.

This fear spurs the nuclear weapons states to urge the non-nuclear weapons states to forego a nuclear weapons program. The non-nuclear weapons states generally accept this on the thesis that their world as a whole will be a safer world if proliferation is halted. At the same time they are entirely aware of the asymmetric circumstances to which they have agreed--nuclear weapons for a handful of nations, but none for themselves. In accepting this asymmetric state of affairs they generally do so in the hope, or even on

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the promise, that the nuclear states will negotiate a reduction in their stockpiles.

Some non-nuclear weapons states have been quite reluctant to embrace a position of abstention. They may well have the economic and technological resources for a nuclear weapons program, and they may have serious enemies, or they may want the prestige of joining the nuclear club. Other nations, not really feeling a need for nuclear weapons, or at least being able to suppress their presumed need for the moment, have been willing to forswear a nuclear weapons program. As a result some modest success has been achieved in gathering signers and ratifiers for the non-proliferation treaty.

Such success as has been achieved is the product of painstaking international negotiations. In the end each sovereign nation must make its own decision, based on foreign policy, economic and military grounds.

The question has been raised as to whether the U.S. should deny civilian nuclear materials and technology to any state not willing to accept more stringent proliferation safeguards than those now being used bilaterally and by the International Atomic Energy Agency. The present proliferation safeguards are, of course, based on materials accounting systems maintained nationally and audits or inspections by the IAEA or supplier nation. These appear to me to be effective against large scale diversions, but much less so against small scale diversions sufficient for initiating a minimum nuclear weapons capability.

It appears to me that what we have achieved in the way of proliferation safeguards is very delicately balanced. There is little room at this point for the U.S. to impose its will on others. While our nuclear technology and materials are still very exportable, they are not indispensable. Other nations can supply them, too. Consequently, such improvements as we may advocate in proliferation safeguards must be arrived at through the process of negotiation.

The IAEA proliferation safeguards never pretended to be anti-criminal safeguards. In fact, anti-criminal safeguards were not applied stringently in the U.S. until recent years. The criminal or terrorist threat has been given greater recognition in the U.S. and abroad in the face of the increasing violence and frequency of terrorist attacks, and as open speculation has increased regarding the use of special nuclear materials by such groups. The open speculation has, I believe, greatly increased the potential threat. Be that as it may, I believe the threat is now sufficiently important that we must be firm in dealing with it.

Officials and industrial leaders that I have met in Europe seem to understand well that adequate anti-criminal safeguards are necessary. They are at work to place their own houses in order. They are talking to U.S. officials in order to exchange ideas for improving the physical protection of special nuclear material. Note that the national considerations which go into anti-criminal safeguards are entirely different from those affecting proliferation safeguards. Every lawful nation is wholeheartedly against allowing criminal elements to misuse special nuclear material. There is no play here of countermanding forces as there is in the case of a nation forswearing nuclear weapons.

Yet, it has been suggested that the U.S. should deny nuclear materials and technology to countries which do not have in place anti-criminal safeguards at least as effective as ours in the U.S. I do not believe that approach is necessary, nor would it be nearly as effective as achieving the same objective through leadership and persuasion. It would offend before it convinced, and it would drive other nations to suppliers outside the U.S. who might be much more diplomatic in their approach. Please note that my end objective is exactly the same--adequate safeguards everywhere.

Before leaving the international scene I want to comment on the importance of U.S. nuclear power equipment and supporting technology to a would-be nuclear weapons state. It would, I believe, be helpful to such a state if it lacked other nuclear resources and knowledge. However, this can be easily overestimated, because launching a nuclear power program is an illogical way to achieve a nuclear weapons capability. After all, modern nuclear generating stations cost hundreds of millions of dollars. U. S. reactors require a supply of enriched uranium which can presently only come from one of the nuclear weapons states. The enrichment for our light water reactors is well below weapons grade. The plutonium generated in the fuel can, if chemically separated, be used to manufacture nuclear explosives. Such an action, however, would almost certainly lead to a cutoff in the supply of enriched uranium fuel. I believe that none of the present nuclear weapons states would supply enriched uranium fuel to a country which was using it in a weapons program. The utility of the nuclear plant, costing hundreds of millions, and the supply of electricity from the plant would be wiped out at a stroke.

Such a course is not a logical way to a nuclear weapons capability. A natural uranium-heavy water reactor of much smaller size, say tens of megawatts and costing a tenth as much is a much more logical route to follow. If built as an experimental reactor, it could use much less demanding technology. Most interested nations could build it with indigenous technical and material resources, and hence possibly without safeguards of any kind, if they so chose. It would make plutonium much more cheaply, probably in a more useful form with less Pu240, and with a much less interruptible fuel supply. The tens of millions it would cost would quite well cover the necessary plutonium processing plant and other facilities. If it were a 50 thermal megawatt reactor, operating at 50 percent of its capacity, it would produce about 9 kilograms of plutonium a year. That's enough to make one weapon per year--a rate sufficient for most countries. Of course, the program could be scaled up, if that were felt necessary. Then one would, in effect, be launching a CANDU type power program, possibly still on a domestic basis.

Turning now to domestic U.S. anti-criminal safeguards, I note that some have implied there is an uncertainty as to whether adequate safeguards at an economically acceptable cost are feasible in a future reactor program involving plutonium recycle for light water reactors and in breeders. It shouldn't be so mysterious. Guarding valuable objects is an ancient art which men have practised for thousands of years. Cave men stood before their caves in pre-historic times protecting their women.

Of course, technology has advanced since those days. Both attackers and defenders can draw on more sophisticated means, but the basics remain the same. Valuables can be protected well or poorly, depending on the effort expended. Estimates have been made that first class safeguards in the eighties and nineties can be had for one percent of the cost of the electricity produced. I would hope that the cost could be less, but even that cost would be economically acceptable.

In any analysis of the safeguards issue the benefits of reprocessing the spent fuel and the commercial handling of plutonium must be considered. Numerous studies sponsored by both government and industry indicate that the consumption of a depletable natural resource, uranium, can be reduced by almost 30% if plutonium is used as fuel in our light water reactors. For each 1,000 MWe LWR this is equivalent to over 3 million barrels of oil annually, and would be a significant step in reducing the U.S. dependence on energy sources abroad and in improving our balance of payments. The net value of fissile plutonium used as LWR reactor fuel is $9000/kilogram which equates to about $250/ounce, more valuable than gold. The benefits of plutonium in the LWR fuel cycle, both in economics and in use of the nation's energy resources, are clear.

Considering the high level of interest in anti-criminal safeguards it may be well to consider the record to date. So far by far the majority of weapons grade special nuclear material has been that in our military programs. The civil nuclear program has produced and transported relatively little. However, taking our total experience, military and civil, the record to date is excellent. There have been no thefts. There have been no diversions. There have been no attacks. There has been no sabotage.

This excellent record is no excuse for complacency. In fact, the record owes much to the dedication of those who made it. Looking ahead, we shall deal with much larger quantities of plutonium than in the past. Certainly all of us agree that the job must be done right. We shall improve, as necessary, our present anti-criminal safeguards system so that it remains fully adequate to meet future situations.

Since the first of the year we have seen a fissioning of the AEC into an ERDA and NRC. NRC, as the regulator and inspector of the civil nuclear industry, is charged with responsibility for the evolving anti-criminal safeguards program. In some quarters there has been an eagerness to see ERDA transfer such responsibilities as it retained to NRC, for example, in the international area and with regard to the R&D in its laboratories. I would simply remind such advocates that ERDA, which includes the former General Manager's side of AEC, has by far the greatest practical experience with special nuclear material, nuclear weapons and the safeguards for these. In fact, ERDA is still the developer and producer of U.S. nuclear weapons. However inappropriate that may seem in an energy research and development organization, it is, nevertheless a fact of life. The security experts of ERDA have worked over the years with the AEC laboratories and the DoD to effect good security for our nuclear weapons and special nuclear materials. They have a continuing responsibility in that regard. I would simply urge that Ken Chapman, who has the NRC safeguards responsibility, and Dodd Starbird who has the ERDA responsibility, should work very closely together. It is my impression that before their recent appointments there was much too little interaction between the two groups. I hope that from here on these two very talented gentlemen will form a close alliance. They are both working on an indivisible problem which in this country's best interest should be addressed in coordination.

At this point I would like to turn to a few specific areas of our anti-criminal safeguards which, in my opinion, need improvement in order to meet future needs. These include items in both the industry's and the government's areas of responsibility.

The principal need for change is in our communications and reaction system. We should deploy a federally operated, high frequency network connecting fixed installations and shipments which involve special nuclear materials. Demonstrations have shown that such a network can be highly reliable in maintaining radio contact with all parts of the U.S.

Reports from this network should feed into a federally operated command center which would be organized to coordinate the response to any attempted diversion or sabotage involving special nuclear materials. Perhaps NRC should be the operator of this system. ERDA could equally well be the operator.

In any case, the responsible federal agency will have to effect agreements with local and state police, the national guard and federal armed forces for the rapid provision of reinforcements to meet emergencies. Where there are capable local law enforcement agencies these are probably best suited for responding to incidents at fixed installations. State and federal forces will usually be most effective for incidents involving material in transit. The agreements will involve state governors for the use of state police and the national guard. They must necessarily involve the President for the use of federal armed forces. Perhaps it would be possible to arrange to pre-position Presidential authority with a duty officer in the White House situation room.

In the event that a diversion attempt were successful, retrieval would become our objective. It appears to me that one or several special recovery forces should be organized and trained by the federal government for this purpose. Such forces would need access to such intelligence information as may exist. Probably they should be a part of the FBI, under the direction of the Attorney General.

This proposed federal communication network, command center, reaction or recovery force and central direction is now missing from our anti-criminal safeguards. In its place are the presently required communications and arrangements with local law enforcement agencies. While these may be adequate for the present circumstances, where our exposure is minimal, they are not sufficient for the future. The federal government should start now to implant a national system for communications and coordination of response forces.

Shipments of special nuclear material represent the most vulnerable point for attack. I believe, therefore, that the federal government should assume custody of such materials in transit and should be directly responsible for the associated security arrangements. The guards accompanying such shipments should be under governmental control and authorized to act under government orders, as necessary. The guards may be government employees or contract guards under government orders. Similarly, the mover may be private under a government contract, or the shipping may be handled entirely by government employees using government equipment. The main point is that the federal government should be responsible for and should directly control shipments of special nuclear material.

The protection of shipments involves physical measures, as well as guards. I am already on record as favoring the use of armed vehicles with immobilizing features for shipments of concentrated special nuclear material. The armor should be such that it deters penetration sufficiently long for reinforcements to arrive. When such armored vehicles are not used extra escort forces should be added, specifically, more than are presently required.

At fixed installations guard and security forces should be under the supervision of the plant management, with one exception. The exception is those guards charged with the use of armed force. These, I believe, should be governmentally organized and authorized, at least as regards their duties which require the use of armed force.

Currently, the NRC is conducting a study mandated by the Congress of a National Security Agency for overseeing the protection of special nuclear materials. What I have just sketched represents my ideas for the responsibilities that the federal government should assume.

The NRC now has the legislative authority to establish an employee clearance program for licensee personnel who have access to significant quantities of special nuclear materials. I understand that they now are working out the details of such a program and I would encourage them in their efforts. The industry, in general, favors such a program. It should, however, be accompanied by checks and balances which will protect the civil liberties of the employees involved. I suggest that we might well have an oversight committee including public members.

Finally, I want to address accounting and monitoring systems for special nuclear materials in process in a plant. Although much effort has been expended on these, the presently available techniques are not accurate enough to verify that important quantities of special nuclear material have not been diverted. Furthermore, they report losses after the fact, not as they are occurring. Despite these deficiencies the industry generally supports the rational application of the present techniques until they can be replaced with something better. We strongly feel, however, that it is not rational to expend a great effort and expense in shutting down plants frequently for overall inventories and in reducing inaccuracies beyond what is straightforward. The results from the present system will still be inaccurate, whatever effort is made. The present system should be used for detecting gross losses or diversions, which is all that it can do.

For the future we may hope to have real time, accurate accounting. I hope to hear more on the feasibility of that at this conference. It is certainly a worthwhile objective. To be feasible such a method must be technically sound, compatible with plant operations and of acceptable cost.

In conclusion, I want to say that industry takes its responsibilities for anti-criminal safeguards very seriously. We are still learning about the nature of the threat and about the best ways to meet it. In partnership with the government we are prepared to do all that is necessary to reduce risks to a very low level which reasonable men can accept. We are absolutely confident that this is achievable in such a way that we can still maintain a viable nuclear power program.

"TECHNICAL OPTIONS FOR PLUTONIUM SAFEGUARDS," A REPORT OF ATOMIC INDUSTRIAL FORUM STUDY GROUP ON FUEL CYCLE SAFEGUARDS

Introduction

The Atomic Industrial Forum, in recognition of the nuclear industry's concern for adequate safeguards, determined that it would sponsor a survey of technical options, including co-location, for reducing the risks in the transportation of plutonium from the reprocessing facilities to fabrication plants.

Mr. Robert V. Curry, Executive Vice President of Nuclear Fuel Services, Inc., was invited to chair a study group on fuel cycle safeguards. Appendix A consists of a list of the study group members. The study group was asked to examine technical options for reducing the risk in plutonium transport and for the operational and economic impact of these options on the fuel cycle.

This report is composed of (1) the study's principal findings, conclusions and recommendations, and (2) a series of working papers, developed by individual members of the study group, which contributed to the findings, conclusions and recommendations.

In most cases, a quantitative assessment of costs and safeguard risks in the implementation of the various technical options considered by the study group could not be made within the time scope of the study group's deliberations. However, the wide experience in the nuclear fuel cycle of the study group members was employed to indicate, where appropriate, relative costs and safeguard effectiveness.

Scope of Study

The Technical options, which have been suggested for reducing or eliminating the risk for criminal diversion in the transportation of plutonium, and which were considered by the study group, using the decision tree shown in figure 1, are:

A. No Plutonium Recycle
  1. Storage
  2. Disposal (throwaway fuel cycle)

B. Plutonium Recycle
  1. Denaturing or Spiking
    a. Residual radioactivity
    b. Added radioactivity
  2. Mixing/blending
    a. Dilute blend (as proposed by Dr. Karl H. Puechl)
    b. Master blend (20% - 30% plutonium oxide)
    c. Custom blend
  3. Transportation
    a. Safe-secure transport
    b. Reduce number of shipments
    c. Helicopter transport
  4. Co-location

Study Group Conclusions

The conclusions reached by the study group are a result of careful analysis and review of the technical options discussed in this report. The group's conclusions are:

1. That a number of technical options are available to reduce further the risk of criminal diversion in the shipment of plutonium.
2. That each of the technical options has in varying degrees, as should be expected, an adverse effect on the operation of the nuclear fuel cycle: in cost, in radiation exposure, and/or in complexity of operations. A weighing of each of these effects on a case basis should dictate which of the technical options are selected to provide adequate safeguards.
3. That currently available options for protecting shipments of plutonium oxide can provide adequate safeguards at an acceptable cost.
4. That process options such as blending plutonium and uranium oxides can reduce the utility of the material for criminal purposes.
5. That denaturing or spiking are not viable technical options for reducing the risk in plutonium shipments.
6. That co-location of reprocessing and fuel fabrication plants can reduce further the risks of criminal diversion of plutonium shipments, but in doing so imposes institutional problems. In practice co-location may be expected to evolve based on economic incentives.

Study Group Recommendations

As indicated in the report's findings on various technical options, most would reduce the risk of criminal diversion in plutonium recycle. However, as can be expected, each option has certain advantages and disadvantages in the operation of reprocessing, fabrication and reactor facilities. The study group carefully weighed the advantages and disadvantages of each of the technical options to determine its relative benefits in reducing risks and in effective operation of plutonium recycle. The following recommendations constitute the results of this analysis:

1. Developments in transportation safeguards, including safe-secure vans and special tactical escort vehicles, whether designed and/or operated by ERDA or by the commercial sector of the industry, should be used for transportation of plutonium oxide.
2. Industry shipments of plutonium oxide should be integrated with the ERDA high frequency communications network and response system.
3. The shipment of plutonium between fuel reprocessing and fabrication plants, and co-location of such plants as an economic alternative to safeguarded transportation, should remain as options.
4. The following alternative may be considered, when and as practicable, to reduce the costs and/or increase the effectiveness of safeguards for plutonium shipments:
    a. Reduce the *number* of plutonium oxide shipments to each fuel fabrication facility.
    b. Institute blending of 20% to 30% plutonium oxide in uranium oxide at reprocessing plants.

c. Use helicopter transport for direct delivery within flight range of the equipment.

The recommendation for the use of helicopter transport is based on the assumptions that the helicopter will be provided adequate protection, i.e. an escort helicopter, and that an economic payload including the containers is achievable.

Study Group Findings

A. No reprocessing

There are a number of comprehensive studies underway in industry to examine the fuel cycle alternatives, which would be possible if plutonium were not recycled in light water reactors. Since, as discussed in the report, the study group concurs with the GESMO conclusion that adequate safeguards can be provided by various technical options which have been identified, the industry studies will serve to delineate the cost benefits of these options as compared to the alternative of not recycling plutonium. These industry studies, now in progress, are expected to be published before the end of the calendar year.

B. Reprocessing

The findings which follow all involve measures in a fuel cycle which includes the reprocessing of spent fuel.

1. Denaturing or Spiking

Two concepts for denaturing or spiking to improve safeguards were considered by the study group. The first concept is the denaturing or spiking of the plutonium to increase the ease with which it can be detected by doorway monitors or survey instruments. Although this concept is feasible, in the opinion of the study group, little would be gained by its use. Currently, instrument sensitivity can detect very low levels of plutonium oxide or mixed oxides without adding material only for detection purposes.

The second concept of denaturing or spiking to make plutonium hazardous for criminal diversion was carefully reviewed by the study group. It appeared that massive dose rates in excess of 10^5 R/hour would be required in order to incapacitate or kill within one to two hours, assuming two inches of lead shielding were employed.

Two procedures for increasing radioactivity were considered:

a. Residual radioactivity

- Allowing a portion of the fission products to accompany the plutonium throughout the recovery process.

To be effective as a deterrent, materials present in discharged fuel should provide adequate dose rates and have a half life of at least two years to insure that fuel coming out of temporary storage maintains its deterrent capability. The study group's analysis indicated that only cesium-137 meets these criteria. Cesium, however, was found to have two associated problems that prevent it from being a practical source. The chemistry of cesium would make it difficult to co-extract with the plutonium, using present commercial reprocessing technology. Further, in subsequent oxide processing steps a major separation of cesium and plutonium oxide would take place leaving a much reduced gamma source. Ruthenium and zirconium were considered the next most likely candidate although both fall far short of being an ideal denaturant. Zirconium 95, which is abundant in discharged fuel, has a half life of 65 days and would, therefore, remain effective for a maximum of about two years after reactor discharge. Ruthenium 103 is likewise limited by its 40 day half life. Ruthenium 106, however, does have a marginally acceptable half life of one year and occurs in amounts sufficient to be an effective deterrent. It does have the complicating factor that its chemistry is one of the most difficult of all elements. Maintaining conditions that leave the ruthenium and plutonium together throughout the fabrication cycle would be difficult. In such steps as mixed oxide sintering, significant separation would likely occur or at best the ruthenium behavior would be very unpredictable.

The disadvantages and limitations may be summarized as follows:

1. There is no known available isotope in discharged fuel that meets all the criteria of an ideal denaturant.
2. It is difficult to ensure that the denaturant would remain with the plutonium through all the fuel cycle processing steps.
3. Carry-over of stable fission products, along with other impurities, could have a significant impact on mixed oxide fuel performance and mechanical integrity.
4. Increased radiation exposures would occur to plant operating personnel and a serious conflict with the As Low As Practicable (ALAP) philosophy would be created.
5. Substantial increases would occur in the areas of both capital and operating costs.
6. The effectiveness of plutonium accounting methods would be markedly reduced and there is probability that the requirements for accountability, as now spelled out in regulations, would be impossible to meet.

b. Added radioactivity

- Intimately mixing a high strength gamma source with the plutonium product after reprocessing but prior to further transport, which would remain with the plutonium product throughout the remaining steps of the fuel cycle.

Such a source may be a recovered fission product or a manufactured product. Cobalt-60, a manufactured product, appeared to the study group to be the most viable material because of its appropriate half life, 5.25 years, and high energy gamma rays, 1.17 and 1.33 Mev. The amount of total cobalt (cobalt-60 plus stable cobalt) required for spiking is estimated to be about 10 weight percent based on contained plutonium.

The advantages of this method of spiking are:

1. Current reprocessing flowsheets remain unchanged.
2. Source strength in the plutonium product would be more predictable and could be better controlled.

The disadvantages are:

1. Fractionation of high-level waste to obtain an acceptable fission product spike would be costly and complicated.
2. Use of a manufactured spike such as cobalt-60 would present a major problem because of cost and amount required. An estimate of the cobalt-60 that would be required in the mid 1980's is on the order of 50×10^6 ci/year. This compares with the current total U.S. production of about 10^6 ci/year.

3. Operational problems and substantial increases in both capital and operating costs would result from the heavy shielding requirements. Further, there would be the risk of a much higher incidence of worker radiation exposure.

4. Plutonium accounting methods would be markedly reduced in effectiveness, with a distinct possibility that current regulatory requirements could not be met.

- Placing a tamper-resistant, self-contained gamma source in the plutonium product that could only be removed at the receiving facility. This method would require massive shielding and remote handling for the source loading and unloading operations and would provide an increased deterrent during transportation.

The advantages of a tamper-resistant source are:

1. The added protection would be available during the period of highest risk.

2. Total additional cost to the fuel cycle would be substantially less than other schemes.

3. Spiking sources, such as cobalt-60, would be reusable and the quantity needed, therefore, greatly reduced.

The disadvantages include:

1. The degree of protection is reduced, because the spike is not intimately mixed with the plutonium product.

2. Some reliance on administrative control is required to ensure that the methods of disarming the transport packages are not compromised.

- Inducing activity in the plutonium prior to shipment using irradiation techniques.

The advantages of using irradiation techniques are:

1. Spike is intimately mixed during transit.

2. Reprocessing steps would not be affected.

The disadvantages of this method are:

1. Irradiation has not been shown to be technically practical. Adequate dose rates may not be achievable.

2. Decay times may be either too short for protection or too long not to affect adversely downstream operations.

3. Again, as in all spiking and denaturing concepts, there would be an increased risk of radiation exposures to plant operating personnel creating a conflict with ALAP philosophy.

The study group, in considering the denaturing or spiking concept developed economic parameters comparing relative transportation costs for shipping unspiked versus spiked plutonium oxide powder and mixed oxide fuel assemblies. The cost increment indicated for spiked plutonium oxide shipment is 60% to 70% more than conventional plutonium oxide shipment costs. The transportation cost increment of a highly spiked mixed oxide fuel assembly is approximately four times the cost per assembly for conventional fuel.

The handling of spiked new mixed oxide fuel elements at the reactor site would also require substantial modification in the design of present fuel handling facilities and procedures. Shipping casks for the new fuel assemblies would require heavy shielding resulting in redesign and substantial increase in weight. Of more significance is the requirement for remote handling of the shipping containers and the fuel assemblies with the potential for increased worker exposures. Present plant designs do not accommodate receipt, unpacking, inspection and storage of spiked new fuel assemblies. While a new plant could be designed and built to provide for remote handling of spiked fuel, existing plants would require a substantial portion of present facilities to be torn down and rebuilt, requiring a prolonged shutdown which would be a very expensive modification.

The perceived advantage of denaturing or spiking plutonium is the potential for reducing the risk of criminal or terrorist diversion. A problem exists, however, in making a quantitative assessment of the degree of incremental benefit which could actually be achieved. If it is assumed that the postulated thief has the desire, technical resources and financing to produce a nuclear device, then the difficulty of handling denatured plutonium presents only one more obstacle in an already long, involved sequence, albeit an important one. If the object of the theft is only for reasons of extortion, then denatured plutonium could present an even greater hazard to the public than purified plutonium.

The effects of denaturing or spiking methods, which include intimate mixing of the spiking material with the plutonium product, would significantly change the design and capital cost of reprocessing, fabrication and reactor plants. Because of the spike-created radiation, the entire plutonium process would have to be completely remote using heavily shielded facilities and remote operation and maintenance techniques. In addition, laboratory requirements would increase by an order of magnitude. Both hot cells and the contained equipment would require substantial development effort. Since all sampling and analysis would have to be performed remotely on the spiked material, the complications would be large and costly.

Although all four spiking concepts appear to have severe limitations, the third listed method of using a tamper-resistant self-contained spike during transit appears to the study group to offer the best balance between increased protection and added fuel cycle cost. However, neither this nor any of the other spiking methods have been demonstrated to be commercially feasible. Therefore, it is not possible to conclude that any of the spiking methods can be used on a commercial scale until after such a demonstration has been made.

2. Mixing/blending

One proposal to reduce the risk of transporting plutonium between the reprocessor and the fabricator is to ship a plutonium-uranium oxide. The study group considered several options:

a. Dilute blend (Puechl) which postulates blending of all plutonium and uranium to a mixed oxide of very low plutonium content.

b. Master blend (20% to 30% plutonium oxide) which involves blending to a percentage of plutonium which makes it very difficult to construct a nuclear device without chemical separation of the plutonium from the uranium.

c. Custom blending of plutonium and uranium oxides at the reprocessing site to fabrication specifications.

All three options substantially increase the mass required to be diverted to obtain a critical amount of plutonium, and complicate the process and extend the time to convert the material to a quality suitable to construct a nuclear device. Thus, mixing/blending constitutes a real reduction in the combined success probability of diverting material and manufacturing a nuclear device compared to the alternative of shipping plutonium oxide.

a. Dilute blend (Puechl)

The dilute blend proposal of using a 0.2%-0.4% plutonium enriched mixture in all reactor fuel achieves an improved economy in light water reactors since the plutonium is spread out more uniformly in the fuel resulting in less self-shielding. The study group concluded that the Puechl mode could save an additional 20% in enrichment services and an additional 5% in uranium feed over the conventional plutonium recycle mode. However, the introduction of a universal plutonium "contaminated fuel" in the light water reactor fuel cycle would sharply increase fuel fabrication and handling costs. Existing uranium fabrication plants would require expensive (and perhaps impossible) backfitting and new plants would involve more costly design and construction to meet: (1) more stringent accounting and security requirements for plutonium (2) regulatory requirements for hardening against natural phenomena, and (3) greater contamination control and shielding requirements. Every light water reactor fuel fabrication facility would become a mixed oxide plant with lowered efficiency and higher manufacturing costs. Transportation costs would also increase since all fuel material would require safeguards. In addition, many workers in these steps of the fuel cycle would have higher exposures to radiation in contradiction to the ALAP philosophy.

b. Master blend (20%-30% plutonium oxide)

A mixed oxide blend composition in the range of 20% to 30% plutonium oxide, in the opinion of the study group, could provide increased safeguards without unduly penalizing the fabrication process, although it would require additional facilities at the reprocessing plant. A mixed oxide in the range of 20% to 30% plutonium would be very difficult to use in constructing a nuclear device. The mixed oxide fuel fabricators indicate that they can work satsifactorily with such a mix. However, additional specifications and means for verifying master blend acceptability would be required.

c. Custom blending

The concept of custom blending the plutonium oxide and uranium oxide at the reprocessing facility to 2% to 4% plutonium oxide by specification would reduce the risks in transportation and concentrate the blending process at the reprocessing facility. However, special processes developed by the fuel fabricators in preparing uranium oxide for pellet manufacture require unique procedures and quality control tests to meet the individual specifications of each of the fuel fabricators. These features are not available at reprocessing plants on a custom basis.

In the view of the study group, the master blend process of blending 20% to 30% plutonium oxide with uranium oxide at the reprocessing plant is the most acceptable of the mixing/blending options available. It provides the best balance between risk reduction and economics in these steps of the fuel cycle.

3. Transportation

Transportation is generally considered to be the most difficult safeguards problem. However, industry has a successful model in the nationwide ERDA safe-secure system for highway shipments of government-owned plutonium.

a. Safe-secure transport

The ERDA system incorporates special penetration-resistant and self-immobilizing vehicles, special tactical escort vehicles, and a nationwide dedicated communications system for monitoring the status of all shipments. The system is designed so that diversion of the cargo by unauthorized persons could be delayed until response and recovery forces could arrive and regain control of the shipment. ERDA safe-secure trailers have been in operational use since October, 1972 and have accumulated nearly 900,000 miles of service. ERDA is developing a van-body truck to provide a smaller vehicle which will also incorporate penetration deterrence, mobilization access control, driver protection and communications. This prototype vehicle will be used by ERDA to demonstrate to the nuclear industry an example of transportation safeguards. The commercial sector of the industry also has the capability to design and develop safe secure transport, which would be equivalent to an ERDA vehicle. The industry should retain the option to develop such a vehicle allowing economics to be the determining factor of design selection.

ERDA's nationwide voice communications system, which has been operational since 1972, is being modified by adding a digital system to expand communications capacity, to increase reliability, and to decrease vulnerability. The system which will begin operations late this summer will have added capacity for monitoring industry-wide shipments of industry-owned as well as government-owned plutonium.

b. Reduced number of shipments

Although it is impossible to completely eliminate all transportation risks, it is possible in the opinion of the study group, to minimize the number of plutonium shipments by providing appropriate storage capacity at the reprocessing and mixed oxide fabrication facilities, and economically feasible to provide safeguard systems for those shipments, which will essentially deter or prevent criminal diversion. Fortunately there is a sufficient technical base to continue improving transportation safeguards and to provide exceptionally high levels of security.

c. Helicopter transport

In recent years, helicopters operating in regularly scheduled service have experienced a high degree of reliability and safety sufficient to permit the commercial carrying of passengers. Newer designs are expected to exceed this safety level by a wide margin.

Helicopters with recent improvements in safety and reliability appear to offer advantages for the shipment of plutonium oxide within the operations range of the equipment. Various fixed wing aircrafts would also provide similar advantages. The following is a listing of some of the advantages apparent to the study group:

1. Minimal ground support facilities required.

2. Loading and off-loading of material inside controlled parameters.

3. Control over crew training and expertise.

4. High degree of route control

5. Security in flight-radar followed, short transit times, existing rapid communications system.

6. Not dependent on varying conditions of route (e.g. road repair, traffic, flooding, snow, reduced speed tracks).
7. Relatively insensitive to labor disturbances.
8. Flights can be limited to daylight in good weather conditions.
9. Design concepts for helicopter shipping containers are under development.

The disadvantages are:

1. Higher equipment and operating costs.
2. Limited range (about 400 miles).
3. If high-jacked the helicopter provides great flexibility in evading pursuit.
4. Accident consequences more severe.
5. Weather limitations.

4. Co-location

Locating mixed oxide fabrication plants in close proximity or adjacent to reprocessing plants in integrated fuel cycle facilities was examined by the study group since shipment of plutonium in its pure form between reprocessing and fabrication facilities is considered to involve the greatest risk for criminal diversion. To the extent such shipments would be minimized or eliminated the safeguarding of plutonium would be enhanced by co-location. Co-location might also make it possible to use physical protection measures more effectively to prevent criminal diversion. However, there are a number of institutional and legal factors which make the concept of co-location difficult to realize in practice.

The diverse geographical location of existing reprocessing and fabrication facilities essentially precludes co-location during the development stage of the mixed oxide fuel industry. Thus, fuel cycle facilities' integration is considered to have a long-range potential rather than being a viable near-term alternative. Such integration or co-location has possible long-term merit only if a number of problems such as the following can be satisfactorily resolved:

1. Maintenance of competition among suppliers.
2. Freedom of fuel service purchasers to select specific suppliers for each phase.
3. Fungibility of reprocessor output from the standpoint of economic value.
4. Availability of a sufficient labor pool.
5. Disruption of an entire site by difficulties with materials, labor, services or other factors.
6. Overlapping jurisdictional interests of Federal (Corps of Engineers, NRC, EPA, DOI, etc.) state and local agencies.

There are currently a relatively large number of fuel vendors, each of which has tentative commitments to supply mixed oxide fuel. The present size of the reprocessing and recycle industry does not allow the needed capacity match between the reprocessing facility and the particular fuel fabricator at present or in the near future. Without a precise match, some movement of plutonium to or from the site is inevitable. As stated in the study's conclusions, adequate safeguards can be provided for the transportation aspects of the fuel cycle, commensurate with the type, form and amount of the nuclear materials involved. Application of such safeguards to the limited transportation required in the early years of plutonium recycle should allow for continuation of the presently planned facilities as well as an orderly evaluation of the necessity and means for co-location. That is, co-location would not be necessitated by safeguards considerations, but by the relative economic merits of co-location and the cost of transportation. A course of action which would allow both co-location and safe guarded shipment of plutonium as dictated by operational and economic considerations would avoid the logistical and institutional problems identified above.

Accordingly, the study group found that the most advisable course of action would be to retain co-location as an option and alternative to the costs involved in transportation. As such, co-location may be expected to evolve naturally from economic considerations.

Appendix A - List of Study Group Members

Chairman: Robert V. Curry
Executive Vice President
Nuclear Fuel Services, Inc.

Secretary: Frank W. Graham
Manager, Special Studies
Atomic Industrial Forum

Fuel Cycle Services Committee

Robert B. Atwater
Executive Director of Fuel Supply
Consumers Power Company

Fred W. Kramer
Engineering Manager
Westinghouse Nuclear Fuel Division
Westinghouse Electric Corporation

R. W. Lambert
Manager, Technical Planning
Fuel Recovery Operation
General Electric Company

Roy Nilson
Manager, Quality Assurance &
Licensing
Exxon Nuclear Company

Walter J. Price
Executive Vice President
Allied General Nuclear Services

Hugh Stewart
Vice President, Manufacturing
General Atomic Company

Safeguards Policy Committee

William A. Cameron
Nuclear Representative
The Babcock & Wilcox Company

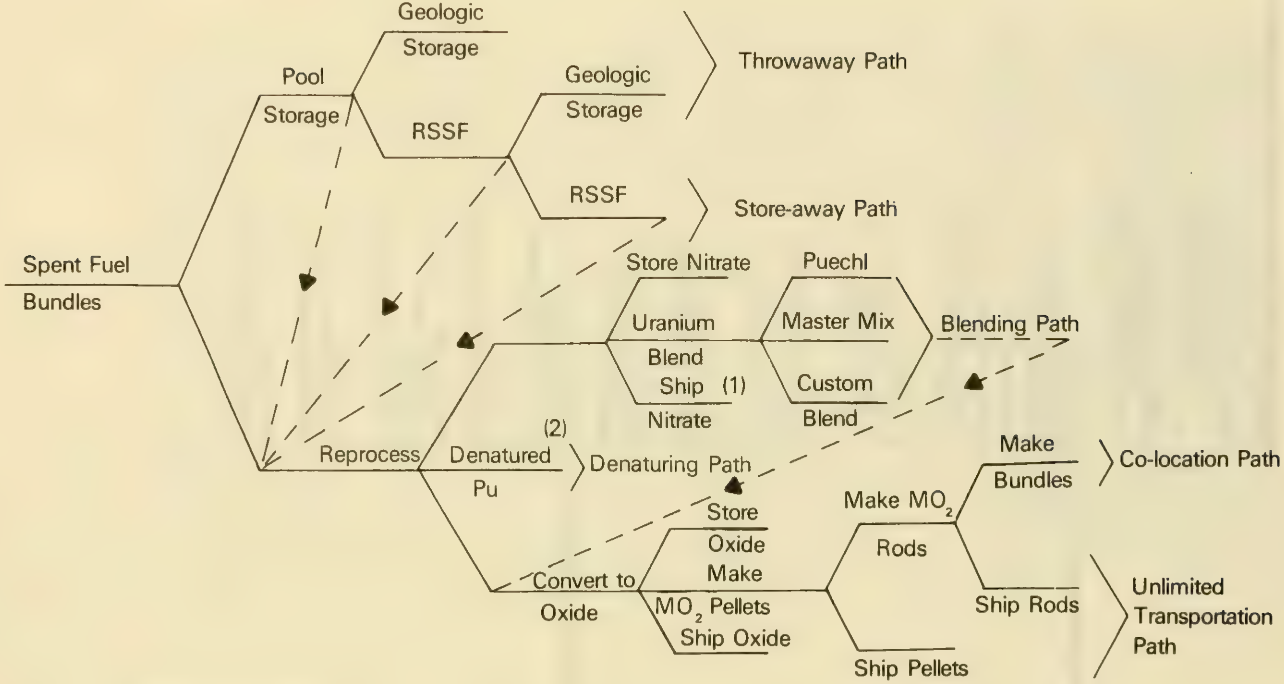
Robert Lowenstein
Lowenstein, Newman, Reis, Axelrad

Charles W. Mayer
Vice President, Nuclear
Transportation
Tri-State Motor Transit Company

Norton Shapiro
Manager, Plutonium Recycle
Combustion Engineering

William Shelley
Director of Regulation & Control
Kerr-McGee Corporation

BACK END CYCLE OPTIONS



(1) Regulation prohibits after 1978

(2) Option follows same path as the convert to oxide chain

Effect of Denaturing on Reprocessing

Introduction

Denaturing (or spiking) Pu has been proposed to meet a wide variety of possible objectives, with the main goal of greatly reducing the possibility of theft or diversion of Pu. This would be accomplished by physically incapacitating the thief or alternately making the material extremely difficult to work with should a theft occur. Other potential benefits such as facilitating location of the Pu in the event of theft, improving the ability to locate Pu in-plant, improving monitoring ability at site exits, etc., have in general been found to fall short of their advertised goals. Analysis of the effects that denaturing would have on the reprocessing step will therefore assume that the objective of denaturing is primarily to reduce the threat of diversion by criminal or terrorists groups.

The discussion will be structured as follows:

1. Techniques and technology of denaturing
2. Effects on plant design and plant capital costs
3. Effects on plant operation and operating costs
4. Summarized advantages, disadvantages, and limitations.

The conclusion reached by examining the above four topics, is that, for the reprocessor, denaturing Pu is neither a simple nor straightforward concept and, in fact, creates substantial technical and economic problems. The need exists to perform an in-depth, cost-benefit analysis in order to give proper perspective to the entire concept. Such an analysis may benefit from studies that are currently being sponsored by the Electric Power Research Institute (EPRI) that are aimed at defining the mechanics and technical aspects of various denaturing concepts.

Techniques and Technology of Denaturing

The denaturing or spiking concept can be achieved in a variety of ways. Four of the ways often considered are summarized below:

1. Allowing a portion of the fission products to accompany the Pu throughout the recovery process
2. Intimately mixing a high-strength gamma source with the Pu product after reprocessing but prior to further transport or processing. The gamma source could be in the form of previously separated fission products or a manufactured spike such as cobalt-60.
3. Placing a tamper-resistant, self-contained gamma source in the Pu product and MO_2 fuel that could only be removed at the receiving facility.
4. Inducing activity in the Pu prior to shipment using irradiation techniques.

For the scope of this report, only the method listed first will be addressed. This approach seems reasonable by the fact that it not only is the technique most frequently proposed, but also the one having the greatest impact on the reprocessing operation. It also offers the greatest degree of safeguards protection.

The first problem that arises in a denaturing concept is obtaining a concensus that defines the criteria for the material to be used as the denaturing substance. Two of the prime considerations are establishing the minimum acceptable half lives for the isotopes to be used and defining the dose rate that needs to be achieved. To cover the variety of circumstances that will be encountered in reprocessing, the gamma source should have a half life of at least 2 years to ensure that fuel that has been in long-term storage, or Pu that has been in storage, would maintain an effective deterrent capability. In this category, only Cs-137 is present in discharged fuel in sufficient quantity to be an effective gamma source. Cesium, however, has two associated problems that prevent it from being a practical source material. The first limitation is that the chemistry of cesium would make it difficult to co-extract with the plutonium using conventional reprocessing technology. The second problem is that in the subsequent oxide processing steps, a major separation of cesium and PuO_2 would take place leaving a much reduced gamma source.

Falling back to the next best source material that would have sufficient gamma strength, ruthenium and zirconium emerge as the most likely candidates. These isotopes, however, also fall short of meeting the criteria of an ideal denaturant. Zirconium 95, which is abundant in discharged fuel, only has a half life of 65 days and would, therefore, remain effective for a maximum of about 2 years after initial reactor discharge. Ru-103 is likewise limited by its 40-day half life. Ru-106, however, does have a marginally acceptable half life of one year and does occur in amounts (~500,000 Ci/te at 160 day cooled) sufficient to be an effective denaturant. Ruthenium has an additional complicating factor, however, in that its chemistry is one of the most complicated of all elements and maintaining conditions that leave the Ru and Pu together throughout the entire fuel fabrication cycle is somewhat of an optimistic assumption. In such steps as MO_2 sintering, significant separation will likely occur or at best the Ru behavior will be very unpredictable.

In spite of these drawbacks, which may in themselves be prohibitive, it will be assumed that Ru is the chosen denaturant and the effects on a reprocessing plant considered. Using established technology, it does appear possible that by making significant modifications a flowsheet could be devised that would leave sufficient Ru with the Pu to be an effective denaturant. It is estimated that about one-third of all the ruthenium present in the discharged fuel could be forced to remain with the Pu. If this function can be achieved, then the resultant dose rates should approach those required to act as a deterrent.

It should be pointed out that the type flowsheet that would allow co-extraction of Ru and Pu would also carry along Zr. The presence of both Ru and Zr would represent a significant chemical impurity to the Pu since only about 5% of the Ru and 0.5% of the Zr are radioactive, while the total amount of the elements would be carried along with the Pu. This level of chemical contaminant (up to 20% of total Pu) could offer significant fuel performance uncertainties either because of failure mechanisms or neutron effects.

An additional problem would arise for the uranium portion of a reprocessing plant by the fact that the type of flowsheets that would allow Ru, Zr, and Pu to be co-extracted also would allow increased quantitites of neptunium and other contaminants to follow the uranium stream. These contaminants would have to be subsequently removed which would add to the complexity of the reprocessing operation.

Effects on Plant Design and Plant Capital Costs

Because the majority of reprocessing is already required to be carried out on a remote basis, the impact on plant design and capital cost would not be as big a factor for reprocessors as in the case of an MO_2 fabricator. These costs, however, would still be significant and can be assigned to four basic areas:

1. The final plutonium processing portions of a reprocessing plant are currently operated on a contact-maintained basis. Because of the denaturant created radiation fields, the entire Pu process would have to be completely remote using heavily shielded facilities and remote operation and maintenance techniques. This increased cost could be partially offset by a decrease in the number of steps required to reach the final Pu product stage.

2. Regardless of plant siting philosophy (with or without co-location), tonne quantities of Pu will have to be stored as a buffer between reprocessors and MO_2 fabricators. Such storage if designed for totally remote operation would require new designs and new concepts as well as being very expensive.

3. Laboratory requirements would increase by an order of magnitude. Both hot cells and the contained equipment would require substantial development effort. Should all sampling and analysis be required to be performed on a denatured basis, the complications could be overpowering.

4. Additional facilities and equipment would be required for uranium cleanup. This most likely would take the form of another cycle of solvent extraction.

The total cost impact of the above-listed requirements has not been detailed, but it could have the effect of increasing plant construction costs in the order of 10% to 15%. It should be pointed out that this relatively low level of impact is applicable only because of the assumption that the reprocessor is not also in the business of converting plutonium nitrate to oxide.

Effects on Plant Operation and Operating Costs

Three major areas of negative impact on plant operations would be created by adoption of a denaturing concept:

1. The potential for achieving meaningful accountability data would be dramatically reduced. There already exists the problem that measurement methods do not currently meet the level of accuracy required to meet the desired limit-of-error limits. Given the case where purified Pu is not acceptable in the laboratory, these goals become nearly impossible. It is hard to visualize successfully designing and operating a mass spectrograph on a remote basis. On the other hand, if purified Pu is allowed in the laboratory, a new scenario can be created that shows that major flaws exist in the denaturing concept. The requirement of achieving adequate accountability in a remotely operated and remotely maintained plutonium nitrate storage facility also presents what appears to be near insurmountable accountability problems. In short, it may well be that any incremental benefit in reducing the risk of overt theft may be more than offset in reduced accountability effectiveness.

2. The use of a denaturing concept would present a dilemma to the reprocessor in terms of meeting the still-evolving, as-low-as-practicable (ALAP) regulatory guidelines. Without question, the exposure incurred by plant workers would be significantly increased. Such tasks as inspecting fixed poisons in Pu processing equipment or storage vessels and disposing or repairing hot failed equipment would result in increased exposures. The laboratory would also present a real challenge in keeping workers within acceptable exposure limits.

3. While denaturing may offer some potential for reducing risk of terrorist diversion, there would be a whole new family of safeguard problems created if denaturing should be relied upon as a deterrent. For example, a new set of scenarios and corresponding countermeasures would have to be analyzed to ensure that the denaturing process could not be circumvented and the undenatured Pu could not be obtained in the reprocessing plant. A simple processing cell sump could be used as a batch contactor to effect Pu purification or a laboratory hot cell could be easily used for Pu cleanup. Taken to an extreme, it would be that accountability systems to keep track of all TBP might be suggested as a way to guard against unauthorized Pu purification.

The overall impact on reprocessing plant operating costs has not been detailed but it can be assumed to be substantial in the areas of manpower levels and equipment replacement and maintenance costs. If viewed against a backdrop of increasingly stringent ALAP requirements, the penalty could grow to become a significant factor in the overall nuclear fuel cycle costs.

Summarized Advantages, Disadvantages, and Limitations

The perceived advantage of denaturing Pu is the potential for reducing the risk of criminal or terrorist diversion. A problem exists, however, in making a quantified assessment of what degree of incremental benefit could actually be achieved. If it is assumed that the postulated thief has the desire, technical resources, and financing to actually produce a nuclear weapon, then the difficulty of handling denatured Pu presents only one more obstacle in an already long, involved sequence. If the object of the theft is only for reasons of extortion, then denatured Pu could present even a greater hazard to the public than purified Pu. It is possible that an extortionist could effectively claim Pu possession by simply parading a spiked inert material.

The disadvantages and limitations may be summarized as follows:

1. There are no known available isotopes in discharged fuel that meet all the criteria of an ideal denaturant.
2. It is difficult to ensure that the denaturant would remain predictably with the Pu through all the fuel cycle processing steps.
3. Carry-over of stable fission products, along with other impurities, could have a significant impact on MO_2 fuel performance and mechanical integrity.
4. Increased radiation exposures would occur to plant operating personnel and a serious conflict with the ALAP philosophy would be created.
5. Substantial, increases would occur in the areas of both capital and operating costs.
6. Accountability effectiveness for Pu would be markedly reduced and there is a probability that the requirements for accountability, as now spelled out in regulations, would be impossible to meet.
7. In the process of achieving the intended goal of denaturing, a new family of problems would be discovered and new requirements would have to be imposed to ensure that the denaturing process was not circumvented.

While the above items represent individual factors that impact on the denaturing concept, an accurate overall assessment cannot be made without performing a thorough cost-benefit analysis. While such a study is outside the scope of this writeup, there are strong indications that the increased degree of safeguard protection will be found to be relatively small and that the costs, particularly when taken across the whole fuel cycle, will be found to be near prohibitive. Such an analysis, we feel, will also show that in the transportation areas, where safeguards risks are the greatest, that alternate solutions such as co-location and shipping MO_2 in cask-like containers, offer essentially the same degree of protection on a more practical basis and with much less cost impact on the fuel cycle.

It should also be pointed out that even should projections and estimates of denaturing costs prove not to be absolutely prohibitive, the added uncertainties and technical risks that are created would, in fact, prove to be a hurdle that private industry could not overcome. In essence, adoption of a denaturing concept would, for all practical purposes, foreclose the development of a privately owned and operated back end of the fuel cycle based on the concept of Pu recycle.

Alternate Denaturing Technique

As compared to the primary denaturing scheme previously discussed, the advantages and disadvantages of alternate denaturing concepts (listed as items 2, 3 and 4 on page 1 of my May 9 draft) are summarized as follows:

2. Back mixing of a gamma source following product purification step at reprocessor

   Advantages

   - Current reprocessing flowsheets remain usable
   - Chemical purity of Pu improved significantly over that of scheme 1
   - Source strength in product would be predictable and could be more closely controlled.

   Disadvantages

   - There would be a limited time when purified Pu would be vulnerable to theft
   - Fractionation of high-level waste to obtain an acceptable fission product spike would be very costly and complicated
   - Use of a manufactured spike, such as Co-60, would present a major problem because of the cost and amount required. An estimate of the Co-60 that would be required in mid 1980s is in the order of $\sim 50 \times 10^6$ ci/year. This compares with the current total U.S. production of $\sim 1 \times 10^6$ ci/year.

3. Placing a tamper-resistant, self-contained gamma source in the Pu and MO_2 products during the transportation step

   Advantages

   - The protection afforded by spiking would be available during the period of highest risk, but the operating and cost penalties associated with MO_2 fab and reactor handling would be avoided
   - Total cost to the fuel cycle would be significantly less than other schemes
   - Spiking sources, such as Co-60, would be reusable and the quantity needed, therefore, greatly reduced.

   Disadvantages

   - Because the spike is not intimately mixed with the product, the degree of protection may be slightly reduced
   - Some reliance on administrative control is required to insure that the methods of disarming the transport package are not compromised.
   - Reprocessing and MO_2 sites must rely more heavily on physical protection to achieve an acceptable level of safeguards.

4. Activation of Pu Prior to shipment

Advantages

- Reprocessing and possibly MO_2 processing not penalized as severely
- Spike is intimately mixed during transit

Disadvantages

- The concept has not been shown to be technically practical. Adequate dose rates may not be achievable.
- Decay times may be either too short for protection or too long to not adversely affect down stream operations
- Cost to perform irradiation would be extremely high

Conclusion

While all four spiking concepts appear to have severe limitations, while offering only marginal benefits, the third listed method of using a tamper-resistant, self-contained spike during transit appears to offer the best balance between increased protection and added fuel cycle cost. It also is the one scheme that might offer a low enough technical risk such that members in the private sector of the industry might still be willing to remain a participant in the fuel cycle.

An Evaluation of Spiking

Introduction

At the April meeting of the AIF Fuel Cycle Committee, Westinghouse was assigned the task of reviewing "spiking" and to establish a position relative to this safeguards option.

This paper presents this review and recommendations relevant to adaptation of this method of increasing Pu safeguards.

Background

In the NRC GESMO, recycle of plutonium was adjudged to reduce the adverse environmental impacts of the LWR fuel cycle, including reactors, relative to the already small effects of the UO_2 fuel cycle. The NRC, however, further, stated that current (mid-1974) safeguards measures to deter, prevent or respond to theft or diversion and/or sabotage of Pu and its process plants are not fully met. By assessment of areas wherein safeguards can be increased, the NRC concluded that combinations of various elements would make the safeguards problem manageable. Of the key six concepts of increased safeguards, the use of "spiked" Pu represented the last concept.[1]

The GESMO defines "spiking" as follows: (from page V-44)

"Intimate mixing of plutonium with other difficult to handle or easily detected substances . . . to improve the following safeguards aspects:

1. Making the plutonium more difficult or hazardous to steal and process.
2. Requiring additional processing before the plutonium is suitable for weapons manufacture (thus providing more time for discovery and recovery).
3. Increasing the ease with which plutonium can be detected by doorway monitors or survey instruments."

Discussion

From the above GESMO definition including objectives, spiking can serve a number of objectives in two broad classifications.

A. Detection

B. Deterrent to Diversion

A. *Detection*

The first item "Detection was reviewed by T. J. Connally in his paper "Spiking Plutonium as a Safeguards Measure".[2] His conclusions were that aerial search for and detection of material diverted during shipment would be of doubtful effectiveness. A mobile ground system, which could collect counts for periods of minutes to days, appears feasible but its area of coverage would be limited. Thus, location of a diverted shipment through visual means by law enforcement officers (current regulations) would be more effective.

Detection of material in a reprocessing or fuels fabrication plant would not be materially improved by spiking since the current state of the art of instrument sensitivity can detect very low levels of PuO_2 or mixed oxides.

Based upon the above observations, there appears to be little gained by spiking plutonium only for detection purposes. If it were spiked, depending upon the mode, detection *may* be enhanced in a plant, at the cost of greatly increased capital and operating costs and with the increased probability of personnel exposures during shipping and processing.

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[1] See GESMO Vol. 1, pg. S-7

[2] Reference

B. *Deterrent to Diversion*

The current detection level for plutonium by portal type monitors is on the order of grams. A spiking level of approximately .1 ppm ^{60}Co or 5 ppm ^{137}Cs would improve the detectability by an order of magnitude. Similarly, such spiking would improve the detectability of diverted plutonium. However, such diverted plutonium would probably be shielded so any improvement in detectability is dependent upon the scenario which has been postulated. For example, it could be in a shielded container, in the basement of a massive building, or in an underground mine or cave.

In order to provide an effective deterrent to a dedicated terrorist bomb builder by spiking, the dose rates would have to be high enough to kill or incapacitate him before a bomb could be assembled. It is also likely that some shielding would be used by the thief without significantly increasing the necessary working time which is considered to be several hours. If he chose to protect his health, expensive remote operations would be required which would greatly increase the time required to build a bomb, thus decreasing the probability of success.

Spiking Materials

Potential spiking materials include ^{60}Co, ^{137}Cs and fission products or actinide left in the plutonium at the reprocessing step. In each case, evaluations would be required to assure that the selected material and quantity would not adversely affect LWR fuel performance and reactor operation. ^{60}Co appears to be the most viable material because of its appropriate half-life (5.3 years) and high energy gamma rays (1.17 and 1.33 Mev). The amount of cobalt required for high level spiking would be on the order of 1 to 4 weight percent ^{60}Co in the plutonium. For comparable unshielded dose rates with a ^{137}Cs spike, approximately equal or even greater quantities of ^{137}Cs than plutonium would be required. Furthermore, the ^{137}Cs is much more easily shielded than ^{60}Co; the half value layer for ^{137}Cs is 0.6 cm compared to 1.2 cm for ^{60}Co. The other alternatives would be less effective than ^{60}Co.

Levels of Spiking

With an objective to prevent a diverter from building a bomb without massive shielded facilities for remote operations and assuming that he must be incapacitated or killed within an hour or two requires massive dose rates and high levels of spiking. It must be assumed that the would-be bomb builder would also be knowledgeable in radiation protection and would take precautions to limit his exposure including the use of lead shielding. Under these assumptions, dose rates in excess of 10^5 R/hr would be required to assure that a bomb could not be built in a short time. This would require approximately 100,000 Ci of ^{60}Co. Assuming a 10 Kg quantity, the level of spiking would be about 1% ^{60}Co in the plutonium.

Impact of Low Level Spiking

Increased levels of spiking would provide some improvement in detectability depending upon the scenarios hypothesized. The advantages and disadvantages of low level spiking (approximately 5 ppm ^{137}Cs or equivalent) to improve detectability of diverted plutonium is as follows:

Advantages

1. Improve the detection sensitivity of unshielded plutonium by approximately an order of magnitude.

2. Improve capability of finding diverted plutonium by airplane, car, etc.

Disadvantages

1. Require additional shielding and mechanization of fabrication and fuel handling facilities.
2. Increase exposures to personnel handling mixed oxide fuel.
3. Increased fabrication plant personnel exposure and downtime for maintenance operations.

Safeguarding of shipments would not be enhanced by this level of spiking. The improved detectability for monitoring nuclear facilities is of marginal value since current monitoring instrumentation will detect 1 gram of plutonium. Thus, the increased personnel exposures and fuel costs are not justified.

Impact of High Level Spiking

The advantages and disadvantages of high level spiking (1-4% ^{60}Co) are:

Advantages

1. Massive shipping container would be required to divert a strategic quantity of plutonium.
2. Remote handling and shielding requirements would significantly increase the necessary facility capabilities and the time required to build a bomb.
3. Increased detectability of the material could aid in locating it depending upon the postulated scenario.
4. The diverter would have to accept probable death to attempt to accomplish his objectives.

Disadvantages

1. Massive shielding and total remote operation of all fuel processing functions.
2. Increased exposures to personnel handling mixed oxide fuel.
3. Massive spent fuel type shippping containers requiring increased numbers of shipments and greater population exposures.
4. Require spent fuel type handling and inspection at reactor facility.
5. Increased fabrication plant downtime for totally remote operations with totally remote maintenance.
6. Would require total reevaluations of planned safeguards and accountability systems.
7. Increased risk and consequences of accidental exposures.
8. Would not alleviate safeguards requirements for shipments or facilities.
9. Increased environmental impact and population exposures.
10. Feasibility of totally remote powder handling and fuel fabrication operations and quality assurance have not been demonstrated.
11. Mixed oxide fuel rod and assembly examinations for quality control and assurance would become remote operations.

The increased fuel costs of this system were examined in light of current Westinghouse experience with the Recycle Fuels Plant design. It appears that a fuel cost addition of $250-$800/kg of mixed oxide would result depending upon the choice of spiking material and level of the spike. For the lower additional cost, assumptions were made that permitted the spikant to be removed in a hot cell by chemical separation operations, powder was then made and fuel fabrication proceeded through rod loading testing and examination. A second hot cell would then affix a tamper proof spike to the rods or assembly prior to shipping off-site. Added laboratory costs and generation and disposal of high level wastes were included in the added cost.

For the higher level fuel costs addition, the assumption was made that the spikant remained in the PuO_2 and a totally remote fuel fabrication and rod loading, assembly operation was required. Here again laboratory analyses and disposal of high level wastes added considerably to costs. The feasibility of totally remote powder processing would have to be established by additional development test programs.

C. *Alternatives to Spiking Fuel*

An alternate spiking method to provide a deterrent during transportation is to locate a highly radioactive source in the fuel container or attached to the fuel assembly. To assure that the shipping container could not be opened without special shielding and remote handling would also require unshielded dose rates in the range of 100,000 R/hr at 1 meter. This method requires massive shielding and remote handling for the source loading and unloading operations and shipping containers. It would provide additional safeguard deterrents during the transportation phase; however, the impact on fuel costs and the environment would still be significant. This additional hazard increases normal personnel and population exposures and adds the possibility of accidental exposures from the sources.

Another alternative is to irradiate the fuel before shipping. In order to provide an effective deterrent over a period of several months, significant exposure levels would be required. This is not feasible for fuel in forms other than fuel assemblies. This method has limited benefits and requires associating special reactor facilities with the fuel fabrication plant, and handling and inspection of the new fuel at the reactor site in a manner similar to spent fuel. This would increase personnel and population exposures.

Recommendations

1. The use of "spiking" as a detection tool is not warranted for two basic reasons. First, since gamma radiation from small amounts of plutonium ($\lesssim 1$ gram) is readily detectable (unshielded) in portal monitors, an attempt to remove the material would be thwarted. In the event of the use of γ-ray shielding metal, detection equipment would also result in an aborted attempt. Second, in the case of large-quantity highjacking, radiation detection serves as a poor recovery device since shielding may be easily provided. Aerial or ground detection would be better served by the placement of radio transmission equipment within a shipment container. In both cases, then increased levels or radiation would not likely enhance detectability.

2. Spiking to serve as a deterrent to diversion imposes severe penalties on mixed oxide fuel costs that are not warranted since other additional safeguards have been and are now being considered to be imposed on Pu recycle such as:

   – Added shipping safeguards

   – Added plant security

Shipment Costs

I. Plutonium Oxide Powder Shipments

A. Conventional:

Container

3500 lb. container having a capacity of 32 kg of Pu and a shield equivalent to 1" of lead. (2700 lb. container plus 800 lb. lead). Cost would be about $12,000/container and would charge out at $30/day.

Transport

A 500 mile (one way) trip was assumed as typical with round trip time (including turnarounds) being 3 days. Transportation costs using a standard vehicle (42,000 lb. load of 12 containers) and a separate armed escort would be $2870/trip. (current tariff) Multiple trips were assumed so special dead heading charges were not added (also such charges should roughly balance out on a differential comparison basis).

Cost

Cask – $30/day X 3 days ÷ 32 kg = $2.81/kg.

Transportation $2870 ÷ 12 containers

÷ 32 kg. = 7.47 kg.

TOTAL $10.28/kg.

B. Spiked:

Container

6000 lb. container having a capacity of 32 kg of Pu and a shield equivalent to 4" of lead (2800 lb. containers plus 3200 lb. lead). Spiked source would be approximately 1000 R. Container cost would be about $16,000 and would charge out for $40/day.

Transport

Same trip and assumptions as under 1A above. Vehicle carrying capacity would be reduced to 7 containers due to increased weight. Facility costs at mixed oxide plant for unloading spiked material within the same time frame as 1A was not included.

Cost

Cask – 40 X 3 ÷ 32 = $ 3.75/kg.

Transportation $2870 ÷ 7 ÷ 32 = $12.84/kg.

TOTAL $16.69/kg.

C. Cost increment of spiked plutonium oxide transport cost over conventional oxide is $6 to 7/kg.

II. Mixed Oxide Fuel Assembly Shipments

A. Conventional:

Container

Similar to that used for normal UO_2 fuel assemblies (FA), plus a small amount of additional shielding. Container and contained assembly would weigh approximately 3500 lbs. Container cost was assumed as $12,000 with a daily use charge of $30 day.

Transport

Transport distance and cost would be the same as 1A for a load of 12 fuel assemblies. Total turnaround time was assumed as 4 days (rather than the 3 used in 1A) due to increased fuel assembly handling and storage problems.

Cost

Cask – $30/day X 4 days ÷ 1 F/A = $120/FA

Transportation $2870 ÷ 12 FA = $240/FA

TOTAL $360/FA

B. Spiked:

Container

A 40,000 lb. (loaded) container having a shield thickness of 2½" of lead was assumed with a capacity of 6 fuel assemblies. Cost would be approximately $120,000 and it would have a daily use charge of $300/day.

Transport

Same as IIA except transport capacity is reduced to one container holding six fuel assemblies.

Cost

Cask – $300/day X4 days ÷ 6 FA = $200/FA

Transportation $2870 ÷ 6 FA = $478/FA

TOTAL $678/FA

C. Cost increment of spiked mixed oxide fuel assembly transport over conventional oxide is $300-$400/fuel assembly.

D. Highly spiked mixed oxide fuel assembly shipments

Container

A 44,000 lb. (loaded) container with an equivalent lead thickness of 5½ inches would be required. This would have a carrying capacity of three PWR fuel assemblies. Since the container weight is approximately the same as that used previously; cost would similarly be equal at $120,000 (A $300/day use charge).

Transport

Same as IIA (of previous submittal) except that the transport capacity is reduced to one container holding three fuel assemblies and an additional three day demurrage charge would be required by the transporter.

Cost

Cask – $300/day X 7 days ÷ 3 fuel assemblies = $700/Fuel Assembly

Transportation – $2870/trip + 3 X $250/day ÷ 3 fuel assemblies = $1210

TOTAL $1910/FA

E. The transportation cost increment of a highly spiked mixed oxide fuel assembly over conventional oxide would be approximately $1500 per assembly.

The Impact of Spiking on the Utilities

Introduction

"Spiking" has been suggested as one of several alternatives to improve safeguard measures to deter or prevent theft or diversion of plutonium. Papers presenting a general evaluation of the impact of "spiking" on fabrication and reprocessing plant operations and costs and on transportation costs have been submitted by members of the Fuel Cycle Safeguards Study Group. Those papers discussed various concepts for spiking, evaluated several possible isotopes and reviewed associated advantages and disadvantages.

The impact on the utility of "spiking" plutonium contained in new fuel assemblies will be primarily felt in the areas of:

1. Physical plant
2. Plant operations
3. Personnel exposure
4. Fuel cycle cost

In discussing the impact on utilities, it is assumed that the spiking level, irrespective of method, is intended to incapacitate or kill a would-be divertor.

Discussion

On-site receipt of spiked fuel assemblies can be accommodated only through substantial modification of present fuel handling facilities and procedures.

Shipping casks for new fuel assemblies must be shielded contributing to substantial increased weight. Of more significance, however, is the requirement for remote handling and its impact on shipping cask design. The present new fuel shipping container designs do not contemplate remote handling. The many bolts and fasteners on shipping containers which require contact work must be replaced by locking devices which lend themselves to remote operation. A shipping container designed for remote opening and removal of fuel assemblies also reduces the difficulty and time that unauthorized individuals would have in opening such a container.

If a self-contained gamma source is placed in the shipping container, facilities must be provided at the plant site to remotely remove and temporarily store the source. Conceivably, the new fuel, following the opening of the shipping container and source removal, could be handled using existing receipt, inspection and storage procedures.

If the spiking concept includes fission product retention, intimately mixed gamma source or induced activity, complete remote handling of new fuel on site will be required. Existing nuclear plants are not equipped for remote handling of new fuel assemblies.

The major factors to be considered in remote handling of new fuel are:

1. *Location of facilities for opening shipping container.* The spent fuel pool of existing plants could be utilized after substantial modification. As an alternate, a new shielded room with remote handling equipment could be constructed.
2. *Receipt inspection for transportation damage.* Present inspection devices and procedures do not lend themselves to remote operation. New devices to measure overall fuel assembly dimensions, envelop, rod spacing, etc and to provide visual inspection must be designed and built.

3. *New fuel storage facilities.* Present new fuel storage facilities will not accommodate spiked new fuel. Spent fuel pools could be utilized. Modification of new fuel storage areas to include substantial shielding may be possible in some instances. Construction of a new facility to accommodate spiked fuel storage is possible.

Location for container opening, receipt inspection and new fuel storage could conceivably all be accommodated in the spent fuel storage pool after substantial modification. However, a very real possibility exists that the capacity of the present spent fuel storage pools will be inadequate to store the quantities of spent fuel if continued delays in licensing and operation of reprocessing plants occur. Two alternatives then appear most probable for existing plants. The first alternative involves substantial plant modification to provide new facilities to receive, unpack, inspect and store spiked fuel utilizing remote handling. This alternative will require major capital expenditures and a period of one to three years to complete. Possibly, an extended plant outage will be required to interconnect electrical and mechanical systems. The second alternative is to forego the use of spiked mixed oxide fuel.

Conclusion

Present nuclear plant designs do not accommodate receipt, unpacking, inspection and storage of spiked new fuel. While a new plant could be designed and built to provide for remote handling of new fuel, existing plants would require substantial modification of present facilities. An estimate of the cost for new plants and for modification of existing plants is not available to the writer.

Procedures for receiving new fuel will be greatly complicated if remote handling is required, and, personnel exposure could be expected to increase.

In the final analysis, it is the electric customer who will ultimately bear the additional cost of improved safeguards irrespective of whether such additional costs stem from changes affecting reprocessing, fabrication, transportation or the nuclear plant.

Mixed Oxide Shipping

Introduction

One proposal to reduce the risk of transporting plutonium between the reprocessor and the fabricator is to ship from the reprocessor a plutonium-enriched uranium oxide. Several options can be envisioned; the one recently proposed by Karl Puechl postulates liquid blending of Pu and U as plutonium nitrate and uranyl fluoride solutions, coprecipitating and then reducing the coprecipitates to a mixed oxide of very low plutonium content. The recovered U would have been previously converted to UF_6, shipped offsite for enrichment, and then returned to the reprocessor for blending.

This is likely the most economical case; other blending possibilities include:

1. Converting PWR recovered U to UF_6 for enrichment and converting BWR U to UO_2 without enrichment; then coprecipitating or blending U and Pu.

2. Separating fission products from the U-Pu and without partitioning the U-Pu, coprecipitating the mixture. The U enrichment needed would be supplied by blending in higher enriched U enriched from natural U. This alternate eliminates the need to convert the reprocessed U to UF_6.

3. Producing PuO_2 at the reprocessor, converting enriched UF_6 to UO_2 and blending the powders.

The intent of the Puechl proposal would be to produce a "universal" mixed oxide fuel mix containing very small amounts of plutonium in enriched uranium which has purported safeguards advantages discussed later.

The suggested plutonium enrichment level is 0.2% to 0.4%. However, based on projections of LWR fuel fabrication and plutonium availability through 1990, the average Pu concentration (if Pu were spread uniformly among all operating LWR's) would exceed 0.4% by 1985. It does not therefore appear feasible to limit the plutonium composition to only 0.2-0.4% and still utilize all the available Pu. For the purposes of evaluating the advantages and disadvantages of the dilute blend concept, a 0.6% uniform plutonium composition is assumed.

Risk Comparison

The dilute blend concept is proposed as a means to substantially reduce the risk of diversion in the reprocessor-fabricator transportation leg of the fuel cycle compared to the previously-assumed and previously-accepted modes of shipping PuO_2. Its risk can also be compared with other proposals such as co-location, armored shipments, spiking, etc.

An absolute assessment of the risk is not possible without extensive study (e.g., similar to the Rasmussen study on reactor safety). However, the fact that the dilute blend concept substantially increases the mass required to be diverted to obtain a needed amount of Pu and complicates and extends the time to convert the material to weapons quality material constitute real reductions in the combined success probability of diverting and manufacturing a nuclear device compared to the alternative of shipping PuO_2. Compared to co-location of reprocessor and fabricator, the risk is higher. Compared to armored transportation of PuO_2, the risk is probably lower, since it is not obvious that shipping of the dilute blend material would not also require armored protection.

Whereas the concept can indeed result in a *real* risk reduction compared to other alternatives, the value of this reduction may not be apparent to the public, who will well be the final judge in the use of plutonium. *Plutonium* is *plutonium* to the average layman, and to convince him that a long convoy of armored trucks containing massive amounts of $UO_2 PuO_2$ is safer than a smaller armored convoy containing more concentrated PuO_2 will be difficult. Likewise, the increased time and complexity in converting the material to a weapon by the use of the dilute blend concept will also not be given much weight by the public, again for the reasons cited.

Thus, one can conclude that, although the concept does provide a real reduction in the success of illicit use of plutonium, this reduction will not be sufficiently understood or credited by the public to be a useful alternate in achieving an acceptable plutonium safeguards program. This conclusion is subjective, and to be fair it is necessary to look at the other cited advantages of the concept.

Economics

The proposed plutonium recycle mode using the 0.2-0.4% plutonium enriched mixed oxide does achieve a better neutron economy in the reactor since the plutonium is spread out more uniformly in the fuel resulting in less self-shielding. The February 20, 1975, *Nucleonics Week* article, which described the Puechl approach, quotes a savings of 40% (vs. 15% for conventional plutonium recycle) in enrichment requirements and a savings of 16% (vs. 12%) in uranium requirements. This quotation is in error. What Mr. Puechl claims is that the SWU value of the plutonium is increased by 25% and the ore value is increased by 6%. These savings appear to be reasonable. Calculations for a BWR give the results shown in the table below.

ORE and SWU Savings

	No Recycle	**Conventional Recycle**	**Dilute Blend Recycle**
	3 w/o UO_2	¼ HM at 3.15 w/o MO ¾ HM at 3.00 w/o UO_2	0.6 w/o PuO_2-2.4 w/o UO_2 (No enrichment penalty)
SWU/Kg U	4.306	3.23	3.018
Kg Feed/kg U	5.479	4.359	4.305
SWU Savings vs. No Recycle	–	1.076 (25%)	1.288 (29.9%)
Kg Feed Savings vs. No Recycle	–	1.12 (20.4%)	1.174 (21.4%)

The table shows that the SWU value of plutonium recycle is 30% by the use of dilute plutonium (0.6%) compared to 25% for conventional recycle, which is a relative increase of 20% (compared to the 25% quoted above). The uranium feed savings increase is 5% relative (compared to the 6% quoted above). Redoing these calculations at 0.2 or 0.4% Pu would yield slightly higher savings.

Assuming that SWUs equilibrate at about $100/unit, the enrichment savings resulting from the dilute blend fuel could amount to as much as $25/kg mixed oxide fuel. Likewise, savings in uranium could amount to another $2-$4/kg mixed oxide fuel assuming yellowcake in the $15-$30/ pound range.

These pure economic savings are substantial if recycle of plutonium is carried out in the U.S. Five years ago, these savings could be assumed to be fully obtainable. However, in today's regulatory climate, the introduction of a universal plutonium "contaminated" fuel to the entire LWR fuel fabrication and transportation process augments the cost of manufacturing LWR fuel in several ways and all or most of these savings will be eroded.

First, the fact that plutonium must now be processed in fuel plants which otherwise were designed for UO_2 fuel fabrication alone will require expensive (and perhaps impossible) backfitting of existing plants and more costly design and construction of new plants to meet 1) the more stringent accounting and security requirements for strategic SNM, 2) the hardening requirements for natural phenomena, and 3) greater contamination control (glove box) and shielding requirements. Every LWR fuel manufacturing plant becomes a mixed-oxide plant with lowered efficiency and higher manufacturing costs. The savings afforded by the improved neutron economy will be offset to a major degree.

Second, the transportation costs will also increase since it is not prudent to assume that the postulated reduced risks in transportation would eliminate the need for guarded and armored convoys. In contrast to the case wherein only PuO_2 shipments to the fabricator require armor protection, now *all* shipments (U and Pu) to the fabricator would require such protection. Although the mass of oxide in the shipments increases by 150-500 times (0.2-0.6% Pu), the increase in shipment mass or volume may not be as great due to the reduced shielding requirements in the dilute form. Nevertheless, the penalty will be large and causes further erosion of the SWU and ore savings discussed earlier.

Third, additional facilities will be required at the reprocessing plant. A hydrolysis plant is needed to convert the enriched UF_6 to a liquid form amenable for coprecipitation with plutonium. Estimated size is 3000 MT/year per reprocessing plant. A U-Pu coprecipitation plant to produce the dilute mixed oxide is required at each reprocessing plant also sized at 3000 MT/year. On the other hand, the plutonium nitrate to plutonium oxide conversion plant would be eliminated. The net cost of these changes will be positive, and again act to erode the SWU and ore savings.

Other Factors

The major economic advantage resulting from decreased SWU and uranium requirements will be offset by the cost penalties discussed. The safeguards improvements, while real, are not judged to be important when viewed by the public. There are other factors which also need discussion.

1. The concept requires an all-or-nothing approach. The entire LWR industry must adopt it. The concept could be initiated prior to 1980-85 and would require a substantial reorientation in the LWR fuel cycle industry.
2. The radiotoxicity of the material handled in the mixed oxide fuel fabrication process is reduced by virtue of the uranium dilution, but overall the radiotoxicity risk is substantially increased since now there will be no low toxicity UO_2 processing.
3. The shielding requirements are reduced by about 35% over that required for conventional mixed oxide processing. However, this reduction is not large enough to eliminate shielding in view of ALAP, and, furthermore, shielding requirements will be extended into the entire LWR fuel line.
4. The "hot particle" controversy is softened in that the radiation from a fuel particle is substantially reduced by virtue of the uranium dilution. However, the issue of the "hot particle" can be refuted technically, and although the controversy still rages, emissions from existing mixed oxide plants are low enough to offset entirely any MPC reductions required to negate any "hot particle " effect on the public.

Preferred Alternate

A mixed oxide blend composition in the range of 30% PuO_2 may provide safeguards advantages without penalizing the fabrication process. Although not known from unclassified information, there should be some level of uranium concentration in PuO_2 which effectively makes it impossible to make a nuclear weapon without chemical separation of the U and Pu. Thus, part of the safeguards advantage credited to the dilute blend concept is preserved. Such a mix may well serve as an ideal input to the mixed oxide fabricator for it can result in easier fabrication particularly, with respect to Pu particle size. Additionally, it ameliorates the "hot particle" problem and is fully dissolvable in the reprocessor's head end. One potential disadvantage to the fabricator is that now the activity of mixed oxide powder with respect to making good pellets is more dependent on the MO powder than in the case of blending PuO_2 and UO_2 at the fabricator. If industry *must* accept a blend concept as a solution to the safe transporting of plutonium, this concept would be by far the preferred route.

Summary and Conclusions

In view of the discussion above, the dilute blend concept is not considered a viable alternate to improve the overall safeguards in that part of the transportation leg between reprocessor and fabricator. Other options of higher assurance and public acceptance exist. Further, the economic advantages resulting from improved neutron economy in the use of mixed oxide fuel will be offset by real cost penalties in transportation, fuel fabrication and preparation of the dilute blend, "universal" mixed oxide form. An alternate concept employing a higher plutonium content mixed oxide product from the reprocessor (30% PuO_2, for example) offers some of the safeguards advantages of the dilute blend approach and is vastly more practical from a fuel fabrication standpoint. If blending is found to be a necessary alternate, industry would be much more receptive to the latter approach.

Co-location

Locating mixed-oxide fabrication plants in close proximity or adjacent to reprocessing plants in integrated fuel cycle facilities (co-location) has been suggested as a means for improving the safeguarding of plutonium. Shipment of plutonium in its pure form between reprocessing and fabrication facilities is thought to be particularly vulnerable to attempted acts of theft or sabotage, and, to the extent that such shipments would be minimized or eliminated, the safeguarding of plutonium would be enhanced by co-location. Co-located facilities might also make it possible to use physical protection measures more efficiently to prevent theft of plutonium.

While the concept of co-location appears to have significant merit, there are a number of social, economic, environmental and political factors which require careful analysis and which might make the concept of co-location difficult to realize in practice. Several of these factors are discussed below with the intent of illustrating several potential difficulties with co-location, rather than of providing an in-depth analysis of the many factors involved. While these difficulties do not necessarily preclude co-location, they do serve to illustrate that careful evaluation of the relative benefits and costs of co-location with respect to alternate methods of improving safeguards should be performed before recommendations to proceed with co-location are made. Some of the more obvious concerns with co-location are discussed below:

1. *Existing Facilities*

The current domestic mixed-oxide fabrication capacity for light-water reactors is approximately 50-75 MT per year. This capacity is largely comprised of five facilities diversely located in the states of Washington, California, Oklahoma and Pennsylvania. There is currently no domestic reprocessing facility in operation. The AGNS plant at Barnwell, South Carolina, however, is well advanced in construction and should be operational in 1976. The NFS plant at West Valley, New York may also be operational with an expanded capacity by approximately 1979. Although construction of additional fabrication facilities is anticipated to begin within the next few years, the mixed-oxide fuels industry will have to rely on these existing facilities and possibly upon non-domestic sources of fabrication until the early 1980's.

The diverse geographic locations of these existing reprocessing and fabrication facilities preclude co-location during the early and essential development stage of the mixed-oxide fuel industry. Consequently, the issue of safeguarding plutonium during transport must be satisfactorily resolved in the near-term, independent of the question of co-location. Assuming that procedures and/or equipment are developed which would allow plutonium to be shipped with adequate safeguards, as indeed they must if the mixed-oxide fuel industry is to evolve to the stage where co-location could be implemented, would imply that the decision on co-location becomes not one of safeguards, but rather one of economics. That is, once these procedures for the safe shipment are developed, co-location is not necessitated by safeguards considerations, and the decision to develop integrated facilities would then be based on the relative economic merits of the cost of co-location and the cost of plutonium transportation.

2. *Evolution of the Mixed-Oxide Fuel Industry*

In the Generic Environmental Statement on Mixed Oxides (GESMO), the demand for mixed-oxide fuel fabrication capacity was assumed to be met by the periodic introduction of 300 MT/yr model commercial scale facilities, with approximately five such facilities required by 1990. While such an assumption is adequate for evaluating the environmental impact of fabrication facilities, the actual evolution of domestic fabrication capacity is expected to deviate markedly from this scenario. There are currently a relatively large number of fuel vendors, each of which has tentative commitments to supply mixed-oxide fuel at such time as the NRC would allow plutonium recycle and commercial reprocessing capability becomes available. As a result, it is anticipated that construction of a number of fabrication plants would be initiated between now and the early 80's. The initial capacity of each of these plants is likely to be 50-100 MT/yr, with the capability of eventual expansion to 300-400 MT/yr. The evolution of the fabrication industry thus is expected to be characterized by the early introduction of a relatively large number of facilities capable of eventual expansion to the 300 MT/yr capacity of the GESMO standard plant. The early introduction of a number of small capacity facilities is necessary to meet individual vendor commitments, while the capability to expand to the 300 MT/yr throughput is necessary for economic reasons.

GESMO identifies the need for about five reprocessing plants of 1500 MT/yr capacity by 1990. Since reprocessing plants smaller than 1500 MT/year do not appear economically attractive, reprocessing plant additions are expected to follow the sequence identified in GESMO, i.e., the periodic addition of 1500 MT/year units, rather than the introduction and subsequent expansion of a number of small-capacity facilities as in the case of fabrication plants.

Through the early 1980's, the AGNS facility at Barnwell and, after 1979, the NFS facility at West Valley, New York are expected to be the sole source of domestic capability. According to the GESMO timetable, the next addition to reprocessing capacity should come on line in 1983, but unless the questions of safeguards and recycle are rapidly resolved and commitments made relatively shortly for this plant, expansion of domestic reprocessing capacity will undoubtedly be delayed beyond 1983. If co-location of fabrication facilities were a requirement, it would become necessary for many of the fuel fabricators to begin construction of fabrication facilities adjacent to one of the two reprocessing plants currently under construction or expansion. During the early 80's, an integrated facility might then consist of a single reprocessing plant and a number of fabrication facilities.

At the larger of the two reprocessing plants, the AGNS facility at Barnwell with a 15,000 MT/year throughput, one might anticipate the construction of possibly three or more fabrication plants. The AGNS facility can support approximately 300 MT/year of mixed-oxide fabrication capacity, and consequently the reprocessing plant capacity and the fabrication plant capacities will be well matched during the early years when the fabrication plants are operating at 50-100 MT/year throughputs.

However, as the quantities of plutonium in the fuel cycle increase, additional reprocessing and fabrication capacity will be required. Additional fabrication capacity could most efficiently be obtained by expanding fabrication facilities adjacent to the reprocessing plant. If shipment of plutonium were to be avoided at this time, the required additional reprocessing capacity would have to be constructed at these original sites. Co-location, consequently, is likely to result in a mature industry in which reprocessing and fabrication facilities are concentrated at a very few sites, with possibly two or three 15,000 MT/year reprocessing plants and two or three 300 MT/year fabrication plants located at each site. While such complexes may prove feasible, a number of issues require careful evaluation before implementation of such a policy is considered: namely, the local environmental impact of these large complexes, public and political acceptance of such large plutonium facilities, and the possible increase in hazards and safeguards risks associated with shipping spent fuel and fresh mixed-oxide fuel long distances to these localized complexes.

Of course, the development of these multi-reprocessing plant complexes could be avoided if fabrication plant sizes were limited to 50-100 MT/yr capacities, so that each fuel manufacturer would have to construct fabrication facilities at several reprocessing plants at various geographical locations. If the industry were to move in that direction, the fabrication plants of vendors would be so fragmented and the throughput per plant so small that fabrication prices would consequently be very high. In order to avoid this problem, one would have to make arrangements to consolidate fabrication facilities at each reprocessing plant into one facility that would service all fuel vendors; the legal problems with this concept and the impact on competitive pricing are obvious.

Even if one assumes that the industry could somehow satisfactorily reach the mature 1990 situation without the necessity of large multi-unit reprocessing complexes or fragmented fabrication facilities, co-location would still not be without serious difficulties. In the mature 1990 industry, five 1,500 MT/yr reprocessing plants and a like number of 300 MT/yr fabrication plants would be required. Presumably, there would be five complexes, each containing a reprocessing and a fabrication facility located at various geographic locations throughout the country. It is, first of all, difficult to see how such complexes could, in practice, develop. Would a reprocessor risk the large capital investment required when his market was tied to the success of the single fabricator located in the complex, or would the fabricator invest in a facility until the reprocessing plant is built and proven? The success of such a complex would be so inter-dependent on the success of the two facilities that it is difficult to envision such complexes except under single ownership. While such single ownership is a possibility, it would mean the integration of concerns with the respective technologies, which may well raise legal questions, and also few single concerns could provide the necessary capital investment; there is the possibility that government subsidy or ownership may be required if such facilities are actually to be constructed. Even if constructed by private industry, such complexes would likely adversely affect the competitive marketplace, since a utility would have to contract for the combination of reprocessing and fabrication prices, rather than the best price for each service as would be possible if shipment of plutonium were allowed.

In summary, while co-location might appear as a straightforward method for improving the safeguarding of plutonium, it cannot serve as the sole solution to this problem in the early stages of the industry, and would lead to an unacceptable situation as the industry matures if complete co-location were required. The most advisable course of action would be to retain co-location as an option and as an alternative to the costly shipment of plutonium. As such, co-location might be expected to evolve naturally from economic considerations to the extent feasible, and problems identified above could be largely avoided.

LETTER TO NUCLEAR REGULATORY COMMISSION FROM THE ATOMIC INDUSTRIAL FORUM REGARDING THE CONGRESSIONALLY MANDATED SECURITY AGENCY STUDY

Mr. S. H. Smiley
Deputy Director for Policy and Planning
Office of Nuclear Material Safety and Safeguards
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Smiley:

The Federal Register, Volume 40, Number 176, dated September 10, 1975, announced the Nuclear Regulatory Commission Security Agency Study and requested comments. The Atomic Industrial Forum's Committee on Safeguards Policy has reviewed the text of the Security Agency Study Scope statement. A list of the committee members is attached.

As a result of the committee's review, the following comments are submitted:

1. It is the opinion of committee members that a graded safeguards system can be structured to provide each step in the nuclear fuel cycle with acceptable safeguards. In a graded system recognition would be given to inherent differences between low enriched uranium and plutonium. It is the committee's opinion that more rigorous safeguards functions such as those applicable to plutonium are appropriate for the government to undertake. These government safeguards functions can be developed within current agencies or through the establishment of a security agency within the Nuclear Regulatory Commission. However, a limited organization within NRC to provide information and advice to established agencies would seem to provide the best course. This arrangement would avoid adding a new security agency, would utilize systems and equipment already available, would utilize information and information gathering capabilities within existing organizations, and would expand the opportunity for rotation of security forces to avoid stagnation of personnel. The safeguards functions appropriate to government include:

    a) The responsibility for the security of materials in transit. Guards may be government employees or contract guards under government orders.

    b) The responsibility for response forces for both fixed site and transit security. Actual response forces need not be federal. Private, state and local forces could also be utilized under government control.

c) A national communications system and command center, perhaps including regional centers, to support and coordinate response forces in the event of attempted sabotage or diversion attempts at fixed installations or during transport.

d) The responsibility to provide a personnel security clearance system for licensee security personnel and those having access to significant quantities of special nuclear material.

2. It seems appropriate to the committee members that these government safeguards functions, whether or not a Federal Security Agency is established, be integrated with the current ERDA security/safeguards system.

3. Guard and security forces at fixed installations should be under the supervision of plant management. The guard and security forces, and physical security measures at fixed installations should be sufficient to detect, report and delay attempted sabotage or diversion until response forces arrive. The delay time required should be determined on a case by case basis.

4. The guard and security forces at fixed installations would be trained in the use of and authorized to carry hand guns. All escalation of the use of force would depend upon response forces.

5. In order to provide NRC with alternatives available to solve security problems with a minimum of operational impact, the committee members recommend that procedures be established for members of industry and major security organizations to advise the Commission on proposed safeguards regulations.

6. The committee also recommends that the NRC consider the establishment of a Nuclear Security Training School to assist in standardizing guard force performance and capability. The

training could be accomplished in the same manner as the Department of Defense's training provided for industrial security personnel.

The members of the committee also considered the series of six other "vital elements" of a safeguards regime included in the scope of the NRC Security Agency Study. There was concern on the part of the committee members that two of the listed elements, i.e., item 1 - the need for continuous inspection of material control and accounting procedures, and item 5 - the responsibility for bearing costs of guard forces were only ancillary to the NRC Security Agency Study and could tend to distract from the central issue of the study. However, with this concern in mind, the following comments address the six "vital elements".

1. "The need for expanded NRC involvement in verifying material control and accounting procedures; e.g., the need for continuous NRC inspections of such procedures".

> The members of the committee do not envision an improvement in material control and accounting through continuous NRC inspection of such procedures. However, with the built-in time delay inherent in material control and accounting, unannounced NRC inspections appear to be a reasonable method of providing additional assurance to the public that material control and accounting is being accomplished properly within the time constraints of the system.

2. "The role of NRC in recovery of stolen special nuclear material".

> The recovery of stolen special nuclear material would logically use nationwide intelligence information and therefore would best be handled within the established government agencies by an FBI operation under the Attorney General. The role of the NRC as viewed by committee members would be in an advisory and supporting capacity providing technical information and assistance in the unique properties of radioactive materials.

3. "Coordination and liaison on intelligence matters and contingency plans between NRC and other agencies".

> Intelligence information available to the FBI, Treasury Department, CIA, Department of Defense, ERDA, and state and local law enforcement agencies has a demonstrated capability for forecasting threats and can be very useful in reducing risks. The committee members do not know if a good mechanism now exists for the prompt reporting of such information to a central, responsible authority and, also, for the prompt dissemination of such information to law enforcement agencies. If it is not being done, as the committee members suspect, this should be corrected. The command center, previously mentioned, could fulfill this function. The contingency planning of the proposed Security Agency would, of course, involve the same federal agencies with which it coordinated intelligence matters.

4. "The extent to which the establishment of a Security Agency within NRC would introduce civil liberties questions not present under existing safeguards arrangements".

> The scope of this element is too broad for constructive comment within the timeframe of the committee's deliberations. However, based on the wide experience in the nuclear fuel cycle of the committee members, it is their opinion that few if any civil liberties' questions not already present under existing governmental security systems would develop.

5. "The responsibility for bearing costs of guard forces, e.g., how costs should be apportioned among industry and government".

> Again, the time constraints of these comments preclude an in-depth analysis of this subject. However, it is the committee's preliminary opinion that the allocation

> of costs should be dependent upon the purpose of the safeguards being considered. In general, those costs involved in protecting society from incidents arising out of social or political causes should be borne by the society. Those costs which are incurred to provide safeguards to protect the employees and property of the industry should be the responsibility of the industry. In areas where an overlap occurs, such as the costs involved in a communications system, they should be shared by both the industry and government. Certainly, working out an equitable solution will require study and analysis.

6. "The use of deadly force for purposes other than self-defense in responding to attempts to gain unauthorized possession of special nuclear materials or to sabotage nuclear facilities".

> The concept of guards, armed and trained in the use of handguns, has been accepted by the industry to provide self-protection while alerting response forces. It seems appropriate to the committee members that any escalation of force beyond self-defense would be the responsibility of the forces acting under government orders as conceived in previous committee comments.

The most effective safeguards appear to be through an industry-government partnership with each carrying out its role where it can do the best job. The members of the committee recognize the importance of protecting nuclear facilities and special nuclear materials at fixed sites and in transit, and believe that the basic goals of industry and the government are the same.

We would be pleased to meet with you or members of your staff to discuss our comments.

Sincerely,

J. Dean Worthington
Chairman
Committee on Safeguards Policy

"REGIONAL NUCLEAR FUEL CYCLE CENTERS" INTERNATIONAL ATOMIC ENERGY AGENCY STUDY PROJECT, SEPTEMBER 1975

BACKGROUND

At the last General Conference (XVIII), the Director General reported that the Agency's Market Survey for Nuclear Power in Developing Countries showed that "Nuclear power is now attractive on economic grounds to about 40 developing countries and should account for more than half of the capacity additions in these countries during the next decade, 1980 to 1990".

As the developing countries proceed with nuclear power programmes at an accelerated pace however, they are likely to encounter problems in financing, assimilation of new technologies, training of local staff, maintaining plant safety, safeguarding of fissile materials, and other related matters associated with the setting up of complete fuel cycle facilities as is already being experienced in many of the industrialized countries. It appears that the best way to solve this complex of interrelated problems is through international cooperation on a regional basis so as to coordinate effectively the development of all steps of the fuel cycle – fuel fabrication, spent fuel storage and transport, spent fuel reprocessing, waste treatment and disposal. The benefits of such an approach would touch all of these potential problem areas. Not only would there be economic benefit from large regional plants but also there would be improved manpower utilization, more efficient technological operations, better security of materials and, very importantly, more efficient radioactive waste management and disposal.

PRELIMINARY STUDY

During October 1974, the Agency's staff made a preliminary study to ascertain whether economic benefits might result from regional centers for nuclear fuel reprocessing and waste management. South East Asia (including the Far East region) was chosen for the preliminary study. While it is typical in many respects to other regions, it also has a diversity of countries with varying degrees of commitment at this stage to nuclear power.

Using up-to-date available forecasts for the region, the fuel discharge schedules for the individual countries during 1990 were calculated by means of the computer code FURY. Three fuel reprocessing and waste management strategies were examined briefly to determine their comparative costs:

I. One fuel reprocessing facility for the region
II. Two fuel reprocessing facilities for the region
III. Local fuel reprocessing facility for each country.

Capital and operating costs for the various reprocessing and waste management capacities that would be required were estimated and totalled for each strategy, and compared.

Assuming a cost index of one (1.0) for the estimated capital investment of the regional plant, Table 1 below indicates the relative differences that were found for this region. The relative index for storing the spent fuel without processing is also indicated

Table 1

Cost Index Comparison of Fuel Management Alternatives

	Capital Investment	Total Operating Charges Over 20 Year Period **
Fuel Reprocessing Strategies:*		
A Regional Facility	1.0	2.6
Two Regional Facilities	1.1	2.9
Local Facilities	1.5	4.1
Fuel Storage Strategy	0.6	0.9

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* Includes waste management through solid waste storage.

** Not escalated.

Indices do not obviously indicate what the potential economic benefits to any individual country are; it is only for the region as an entity. However, these studies did identify the relative impact of fuel reprocessing and the management of the generated radioactive wastes on the overall nuclear power programme. Figure A below indicates the part of the nuclear power generation costs (including costs generally associated with reactor capital recovery, reactor operation and maintenance, and the nuclear fuel cycle), which is attributable to fuel reprocessing and management of the radioactive wastes. The waste management costs include solid waste burial, high-level waste solidification and interim storage of the solid high-level and alpha-bearing wastes.

Both the cost index tabulation and Figure A show there are significant economic incentives for countries with smaller nuclear power programmes to cooperate toward establishing regional centres for fuel reprocessing and handling the resulting radioactive wastes. For example, Figure A indicates that, exclusive of transport costs, it would cost a national power programme of 10,000 MWe generating capacity about twice as much annually, for local reprocessing and waste management as it would to use a regional centre serving a tributary nuclear generating capacity of 50,000 MWe. For any programme less than 10,000 MWe generating capacity, the costs would relatively be much higher.

The preliminary study indicated that sufficient advantages could be identified for regional pooling of reprocessing loads to justify further detailed study. This should include, in addition to technical and economic considerations, other aspects such as legal, institutional, environmental, safety, and fuel cycle self-suffiency.

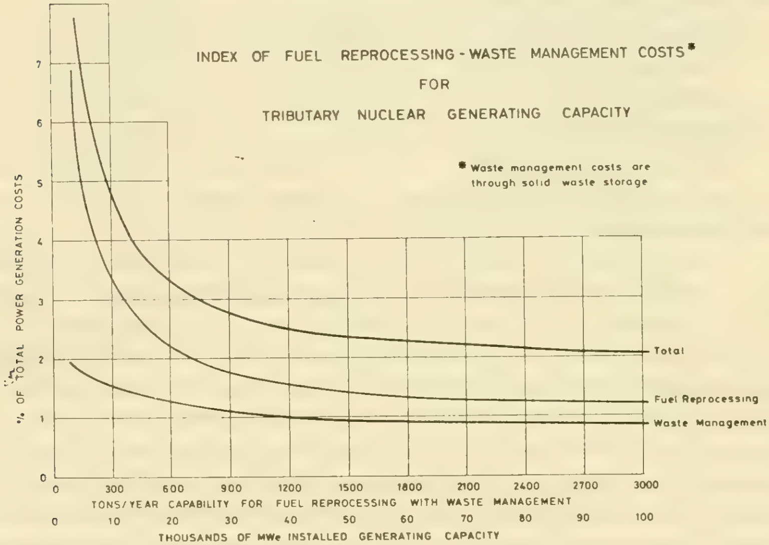


FIGURE A

IAEA INTEREST

Long term planning and international cooperation in relation to the fuel cycle is a logical sequence to the world-wide growth of nuclear power. While most aspects of nuclear power production have now reached the stage of normal commercial and industrial implementation, certain aspects of the fuel cycle such as fuel reprocessing and waste management may turn out initially to be limiting, and hence it is essential that the IAEA studies such potential problem areas on an international scale.

The IAEA's Scientific Advisory Committee endorsed an expanded in-depth study project and emphasised the following points:

1. The study should encompass a fuel cycle centre in a broad form including fuel fabrication facilities as well as reprocessing and waste management.

2. Recognition should be given to the fundamental fact that a major fraction of the environmental, safety and safeguards problems of nuclear power arise because spent fuel is reprocessed.

3. The study should consider all options for handling spent fuel from the time it is discharged from the reactors. This should include storage of the spent fuel for an indefinite period.

4. The transportation aspects of the various options should be given special consideration since this is a strong emotional factor in the mind of the public.

5. If at all possible, centres should be located at sites which offer a good probability of being acceptable for permanent geologic disposal as well as retrievable storage of wastes.

OBJECTIVES OF THE PROJECT

1. To develop the methodology for assessment of alternative strategies for establishment of integrated regional nuclear fuel cycle centres, so as to evaluate their advantages and disadvantages vis-a-vis dispersed fuel cycle facilities.

2. To prepare a report on this methodology, including illustrative examples on approaches and advantages to Member States, for the use of those organisations interested in the implementation of nuclear fuel cycle activities.

3. To provide a mechanism for establishment of a forum where Member States and other interested entities can work out alternative strategies pertinent to nuclear fuel cycle activities.

SCOPE OF THE PROJECT

A "regional" centre would be a flexible concept so that any group of Member States could interface in a given region on economic, geographic or sociopolitical bases. The project is intended, therefore, to provide to the Member States a methodology for coordinating and cooperating with one another in the optimization of nuclear fuel cycle strategies. The study would not attempt to determine actual regions *a priori*.

The project would cover the nuclear fuel transport, storage, processing and recycle activities starting from the time the spent fuel leaves the nuclear power reactor through all subsequent steps until recycled fuel, in the form of fuel elements, is ready for shipment to the reactor. Production of new uranium fuel and enrichment activities are not included, but the study will include those activities involving management of radioactive wastes generated in the fuel cycle.

A regional nuclear fuel cycle center would normally be required when there is immediate need for reprocessing the spent fuel being discharged from the nuclear power stations established in the region. However, such a center, to be economically viable, will have to be of certain minimal or of optimum size. On the basis of the earlier studies carried out by a number of countries, it is considered that the optimum capacity of a fuel reprocessing facility to be located in such a center may lie in the range of 750 to 3,000 tonnes uranium annual throughput. Hence for detailed analysis it is proposed to examine this range initially, and ascertain from the electrical load growth pattern and the nuclear power generation programme as to what would be the earliest period when such a fuel center would be needed in any region. Later in the study cases could be considered where, under certain special conditions even a smaller capacity plant could be desirable.

In the first instance it would be essential to develop a model that would take into account all the important steps in the fuel cycle. The various facilities could be designed to suit a range of parameters which could vary within specified limits, and the model should be able to reflect the effect that each of these parameters would have on the overall picture. For the prupose of preparing this model, the fuel cycle concept which would be relevant to the present study is presented in Figure 1. Some of the basic criteria and assumptions made for the first phase of the study to keep it relatively simple are given in the Annexe.

Taking the fuel cycle concept as set forth in Figure 1, a conceptual economic analysis approach has been developed in the form of fuel cycle programme modules as shown in Figure 2. However, this approach does not take into account all the pertinent considerations and constraints which would also have to be studied in detail. The project would therefore entail four basic types of effort as shown in Figure 3 which would be as follows:-

1. Development of one or more mathematical models and associated computer codes to permit analysis of flow of materials for the nuclear fuel cycle from spent fuel discharge through recycle and fabrication of recycled-fuel elements. The model should enable the evaluation and optimization of various nuclear fuel strategies with respect to reprocessing, storage, transportation and waste management.

2. Development of the requisite inputs for the model. This would require the establishment of some form of data bank, as well as the development of empirical data, such as capital and operating costs of various process plants as a function of size, from best available sources.

3. Development of an analytic system for evaluating optimum strategies including identification of further needed inputs and carrying out appropriate sensitivity analyses as a function of variable inputs with the help of the model.

4. Development of a number of related studies such as legal, organizational, financial, environmental etc., that would be essential to implementation of the regional nuclear fuel cycle center concept.

IMPLEMENTATION OF THE STUDY PROJECT

From an implementation standpoint, the study would be divided into four phases, of which the first three appear in Figure 3. Phase 1 extending through March 1976, includes the preparation of the initial model and computer code; Phase II extending through July 1976 encompasses the initial testing of the model and code. Phase III, extending through December 1976, ends with the preparation of a report detailing the development and application of the regional nuclear fuel cycle centre concept, covering the related model, computer code, input data and illustrative studies. As the end of Phase III, it should be possible to conduct investigative surveys of alternative strategies for regional centres vis-a-vis diverse national centres. However, under Phase IV which would commence in 1977 and cover the in-depth evaluation of any specific regional centre proposal, engineering feasibility studies using consultant architect-engineering sources would be necessary to obtain local data, cost information and other considerations in order to develop definitive construction and operational costs. This phase would also require development of an appropriate framework for implementation of such a project.

With the assistance of the analytic system developed for this study, and the relevant information compiled by the IAEA as part of its activities related to the Market Survey for Nuclear Power in Developing Countries as well as other on-going programmes, it would be feasible to assess the need for storage and reprocessing of spent fuel in the different regions of the world for the period 1975 - 2000. Some of the relevant information that could be generated and which would be useful for further analysis and for fuel cycle strategy planning purposes would be as follows:-

1. The forecasting of spent fuel storage and reprocessing, fuel fabrication and waste management requirements including transport of new and spent fuel and radioactive waste.

2. Forecasting of the impact of alternative strategies for spent fuel storage or reprocessing on fuel supply and demand and the effect of such strategies on radioactive waste management.

3. Determination of the optimized economically viable size and distribution of such fuel cycle centres with respect to load growth patterns.

4. Comprehensive analysis of the various factors so as to identify a series of options that would be available for the formulation of an appropriate strategy for each region.

Finally the study would also review and analyze the experience of other analogous cooperative international ventures with a view towards presenting strategies for developing appropriate frameworks covering the legal, organizational, financial, environmental and other aspects related to the establishment of such regional centers.

PRELIMINARY ILLUSTRATIVE EXAMPLES

Some of the information available as of today has been presented in Figures 4 to 6. To illustrate the general approach towards the analysis to be carried out for any given region, the spent fuel storage and reprocessing capacity that might be needed is presented in Figures 7-1 to 7-3 for three typcial regions. For the purpose of illustration the following three geographical regions were taken:

Region A - Central and South America
Region B - South East Asia, the Far East and Australia
Region C - Middle East and Africa

As the growth of nuclear power in each of these regions (any one of the regions could perhaps be subdivided) is different, the strategy that might be followed in the case of a given region would vary depending upon the need for recycling the fuel - both enriched uranium as well as plutonium - and the type of power reactors being built in the different countries in the region. The alternative of storing the spent fuel for a number of years could also be considered under certain conditions. In any case, initially some amount of spent fuel will have to be stored so that the fuel reprocessing capacity when built, could be utilized at a high enough load factor to make it economically viable.

The important question at first would be to ascertain whether it is at all necessary to reprocess the spent fuel and under what economic conditions (as regards the price of uranium, cost of separative work and price of plutonium) would it be worthwhile. In case reprocessing of spent fuel is economically viable or is essential from the fuel resources point of view, it would be important to determine the appropriate time frame when all the necessary fuel cycle facilities should be available. It would also be important to determine the effect that spent fuel storage vs. fuel recycle strategy would have on the total uranium as well as enrichment capacity requirements for the nuclear power programme in the region.

As financing of such regional centers would initially be a major constraint, it would be necessary to work out the annual requirement of funds to meet the capital cost of setting up the various facilities in regional centers. To illustrate this, on the basis of the available cost data and the cash flow requirement for setting up each of the facilities, the total annual and cumulative financial requirements for Region B are shown in Figures 8-1 and 8-2. It may be noted that the annual requirement would stabilize to about 350 to 400 million dollars to meet the nuclear power generation growth in this region.

The illustrative cost data used is based on the reported information in the literature. However, for detailed evaluation more up-to-date and detailed cost data will have to be developed during the course of this study.

COOPERATION OF MEMBER STATES

A fuel cycle center study of this nature would have its full value only if the relevant input data is developed on a realistic basis. The study must develop and compile relevant process and cost data so that system analysis and sensitivity studies can be conducted as part of the overall fuel cycle strategy evaluation for any specific region. Also in the area of legal, organizational, financial, environmental and other aspects of this study, information on the results of analogous experiences will have to be generated in order to develop strategies regarding the framework that would be well suited to multinational ventures of this type in which both industrialized as well as developing countries would participate on a partnership basis. The Agency, as part of this study project, will be requesting Member States to provide specific information and assistance and will hold Consultant's Meetings to compile and evaluate the relevant input data. The cooperation of the Member States is most essential to achieve the ultimate objectives of this study.

ANNEXE

Regional Nuclear Fuel Cycle Center

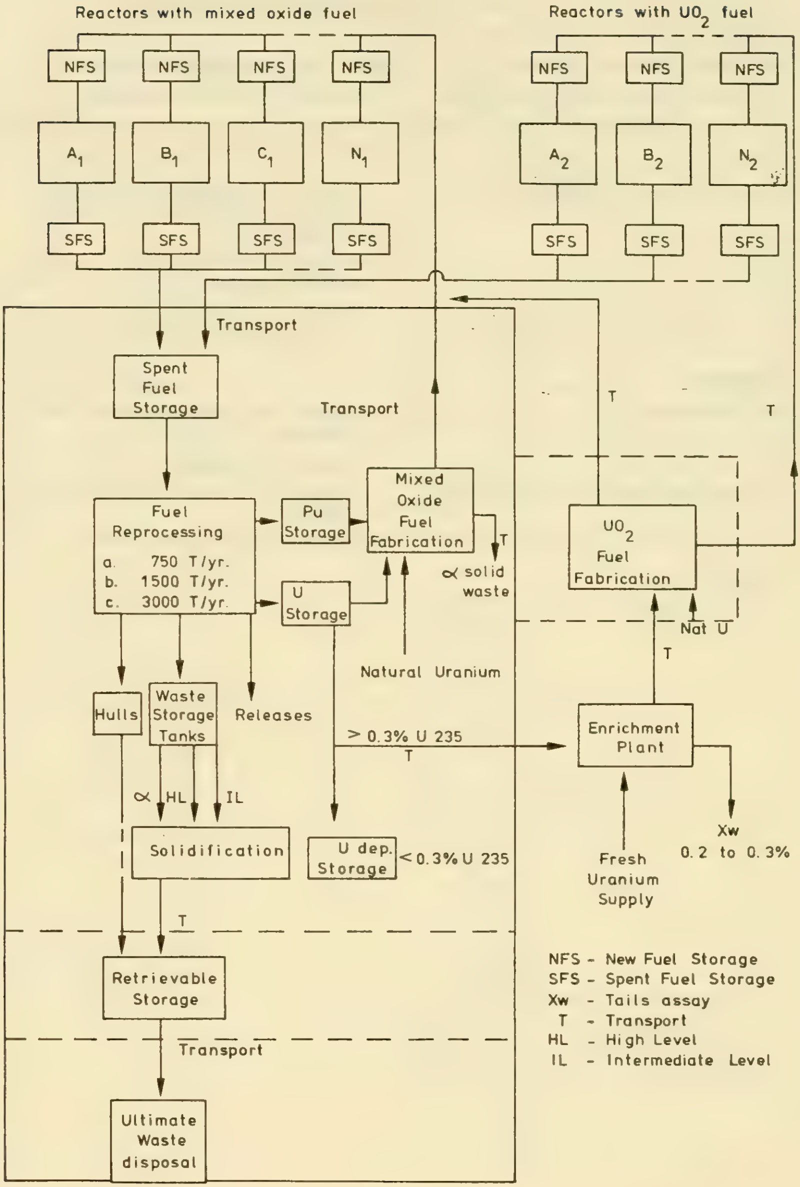
Basic Criteria – Phase I Study

Consideration:	Simplifying Assumptions:
1. Time Period	1985 to 2000
2. Capacity of Reprocessing Plants	750 to 3000 Tonnes/yr
3. Forecast of reactor capacity based on mixed oxide fuel	
Size of reactors	200 MWe to 1200 MWe
No. of reactors	Determined by reprocessing plant capacity, and reactor size
4. Types of Reactors	LWR – 80 to 100% of total installed capacity HWR – 0 to 20% of total installed capacity
5. Fuel cycle characteristics	Pu recycle to be considered. Also deferred fuel reprocessing.
6. No. of Reprocessing Plants	1 to 3 per region initially
7. Fuel Fabrication:	
a. UO_2 fuel	outside of center as well as at the center
b. Mixed oxide fuel	only at center
Manufacturing capacity	Determined by the installed electrical generating capacity
8. Fuel requirements:	
a. Uranium	Annual requirement Integrated total requirement
b. Enrichment plant	Capacity based on a. Pu recycle b. Deferred reprocessing
9. Spent Fuel Storage:	
a. At reactor site	1 to 10 yrs
b. At the center	1 to 10 yrs. Adequate to satisfy optimal fuel reprocessing plant capacity. Alternately, when breeder requirement for Pu demands reprocessing of spent fuel, say 1995 (i.e. 10 yrs storage.)

10.	Pu storage	Up to 1995 if no Pu recycle occurs. Thereafter additional Pu storage capacity not necessary because of its use in breeders.
11.	Radioactive waste management:	
	a. From reprocessing plant	Waste solidification at center
	b. From fuel refabrication plant	Waste solidification at center
	c. From power reactors	Processing at reactor site. Hence not to be considered
12.	Waste storage or disposal	Retrievable storage at center or elsewhere after solidification: for long term For short term up to 10 yrs. most economical method Ultimate disposal at center or at remote location
13.	Transport:	
	a. For spent fuel	In casks according to regulations recommended by IAEA. By road, rail and sea
	b. For radioactive waste and H.L.	According to regulations recommended by IAEA By road, rail and sea.
14.	Discount rate	10%

Figure 1

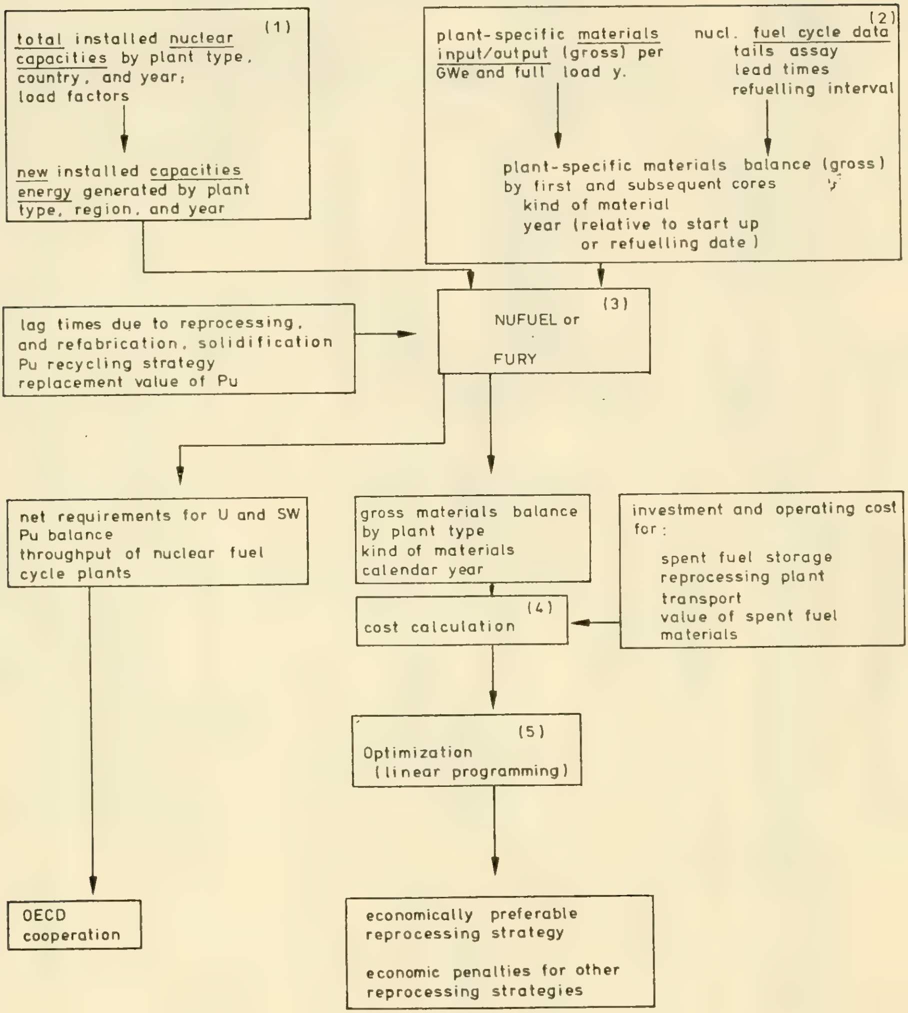
Fuel Cycle Concept



NFS - New Fuel Storage
SFS - Spent Fuel Storage
Xw - Tails assay
T - Transport
HL - High Level
IL - Intermediate Level

Figure 2

Proposal for nuclear fuel cycle program modules


(1)
total installed nuclear capacities by plant type, country, and year;
load factors
new installed capacities
energy generated by plant type, region, and year
(2)
plant-specific materials input/output (gross) per GWe and full load y.
nucl. fuel cycle data
tails assay
lead times
refuelling interval
plant-specific materials balance (gross)
by first and subsequent cores
kind of material
year (relative to start up or refuelling date)
lag times due to reprocessing, and refabrication, solidification
Pu recycling strategy
replacement value of Pu
(3)
NUFUEL or
FURY
net requirements for U and SW
Pu balance
throughput of nuclear fuel cycle plants
gross materials balance
by plant type
kind of materials
calendar year
investment and operating cost for:
spent fuel storage
reprocessing plant
transport
value of spent fuel materials
(4)
cost calculation
(5)
Optimization
(linear programming)
OECD cooperation
economically preferable reprocessing strategy
economic penalties for other reprocessing strategies

REGIONAL NUCLEAR FUEL CYCLE CENTRES PROJEKT

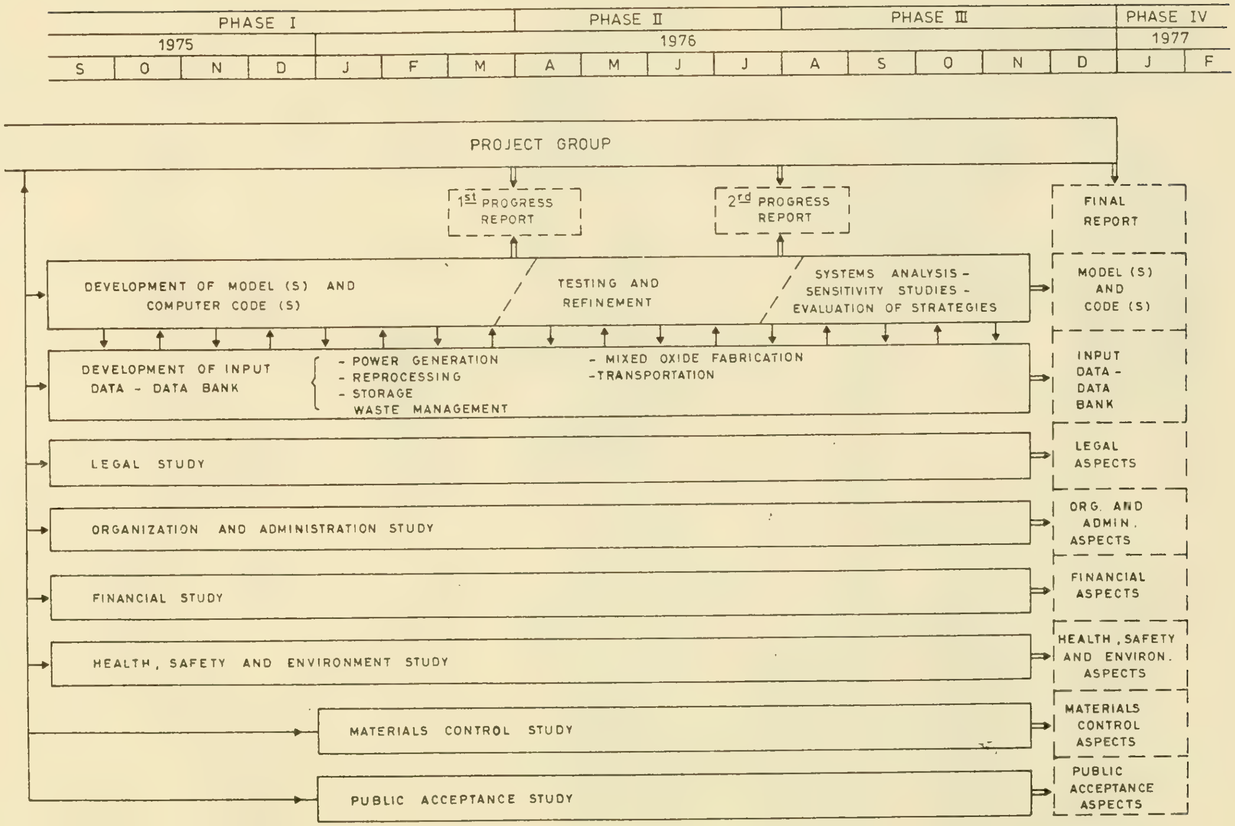


FIG. 3A

REGIONAL NUCLEAR FUEL CYCLE CENTRES

SCHEMATIC STUDY PROJECT AND IMPLEMENTATION PLANNING

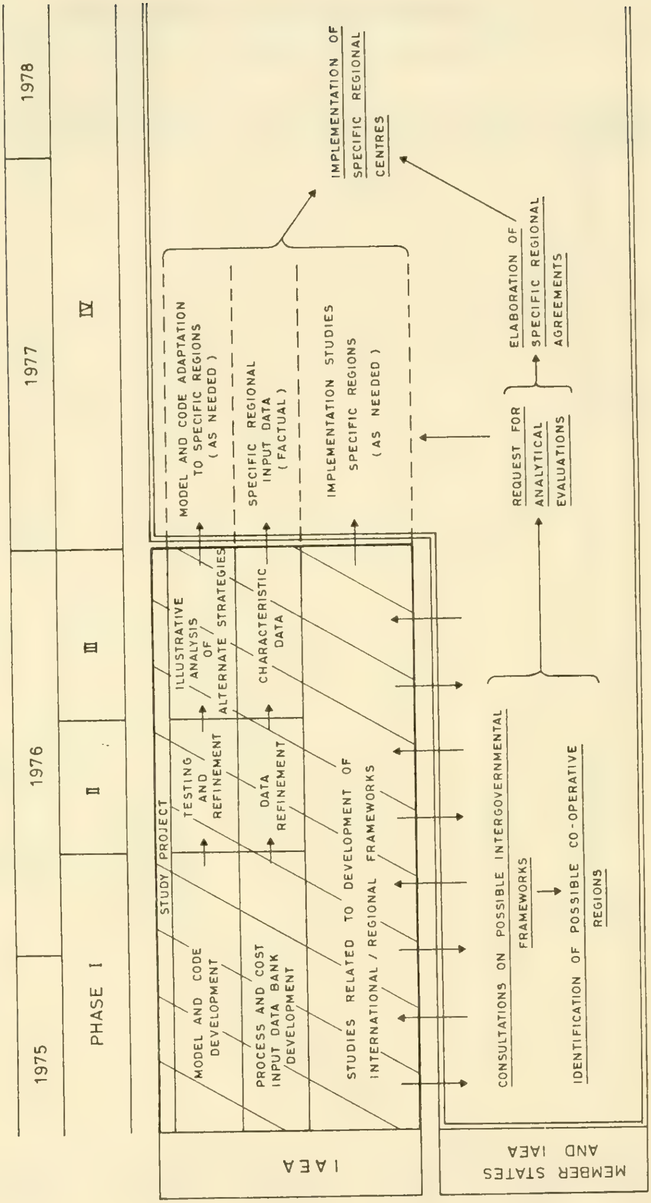
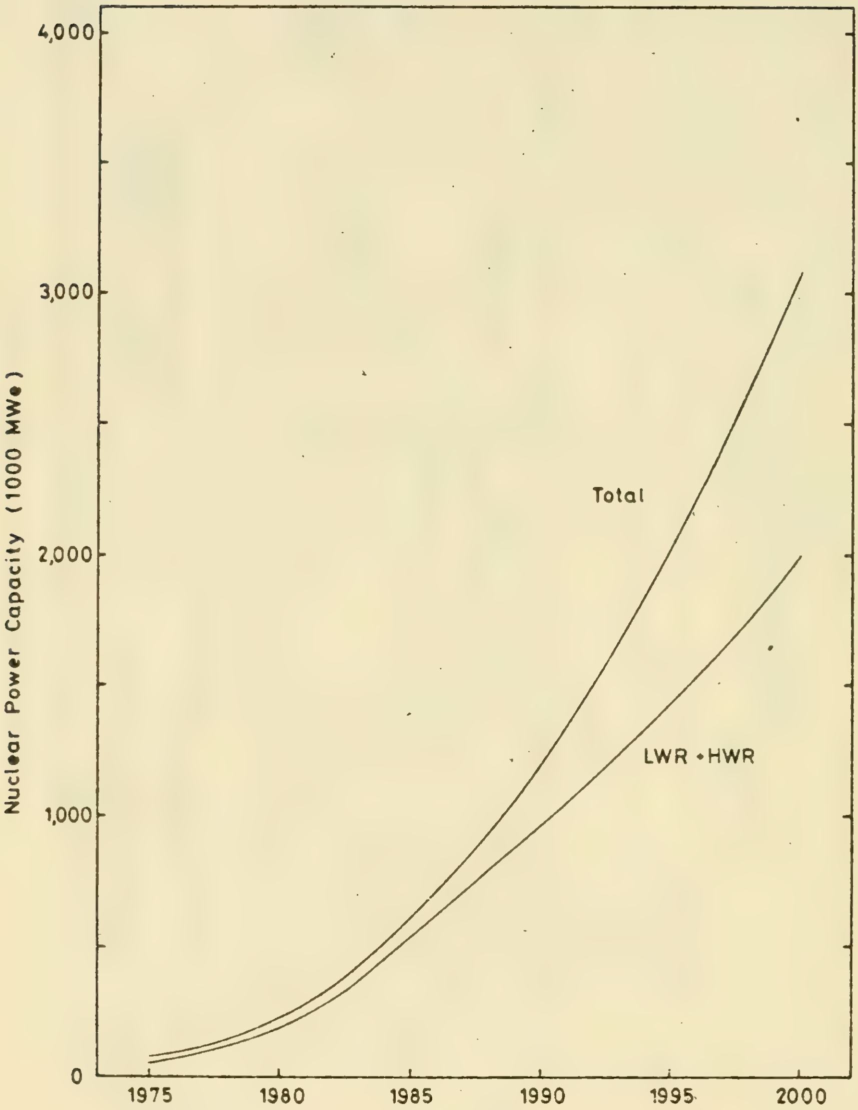

1975
1976
1977
1978
PHASE I
II
III
IV
STUDY PROJECT
MODEL AND CODE DEVELOPMENT
TESTING AND REFINEMENT
ILLUSTRATIVE ANALYSIS OF ALTERNATE STRATEGIES
MODEL AND CODE ADAPTATION TO SPECIFIC REGIONS (AS NEEDED)
PROCESS AND COST INPUT DATA BANK DEVELOPMENT
DATA REFINEMENT
CHARACTERISTIC DATA
SPECIFIC REGIONAL INPUT DATA (FACTUAL)
STUDIES RELATED TO DEVELOPMENT OF INTERNATIONAL / REGIONAL FRAMEWORKS
IMPLEMENTATION STUDIES SPECIFIC REGIONS (AS NEEDED)
IMPLEMENTATION OF SPECIFIC REGIONAL CENTRES
CONSULTATIONS ON POSSIBLE INTERGOVERNMENTAL FRAMEWORKS
IDENTIFICATION OF POSSIBLE CO-OPERATIVE REGIONS
REQUEST FOR ANALYTICAL EVALUATIONS
ELABORATION OF SPECIFIC REGIONAL AGREEMENTS
IAEA
MEMBER STATES AND IAEA

Fig. 4 Nuclear Power Forecast for the World
(Total and LWR + HWR)



Note: Mainland China not included

Fig. 5 Nuclear Power (LWR + HWR) Forecast for Regions A, B and C.

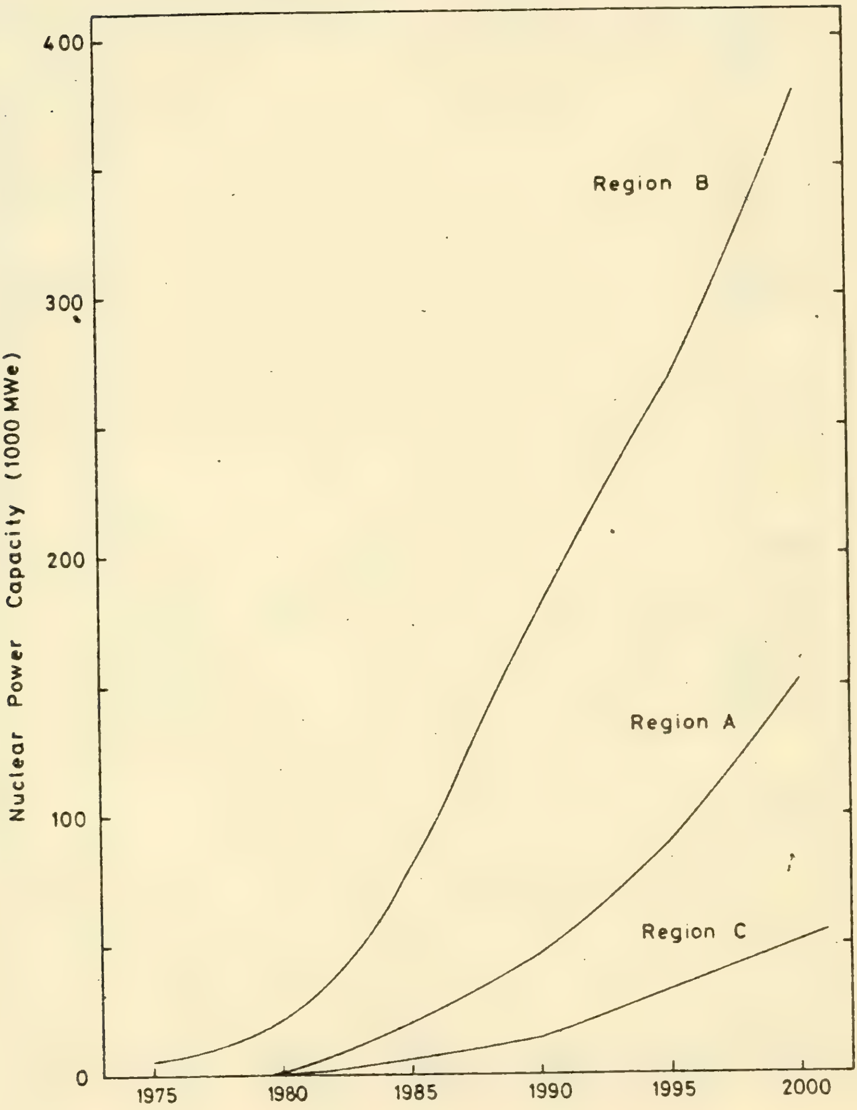


Fig. 6 Quantity of Spent Fuel generated annually in Regions A, B and C.

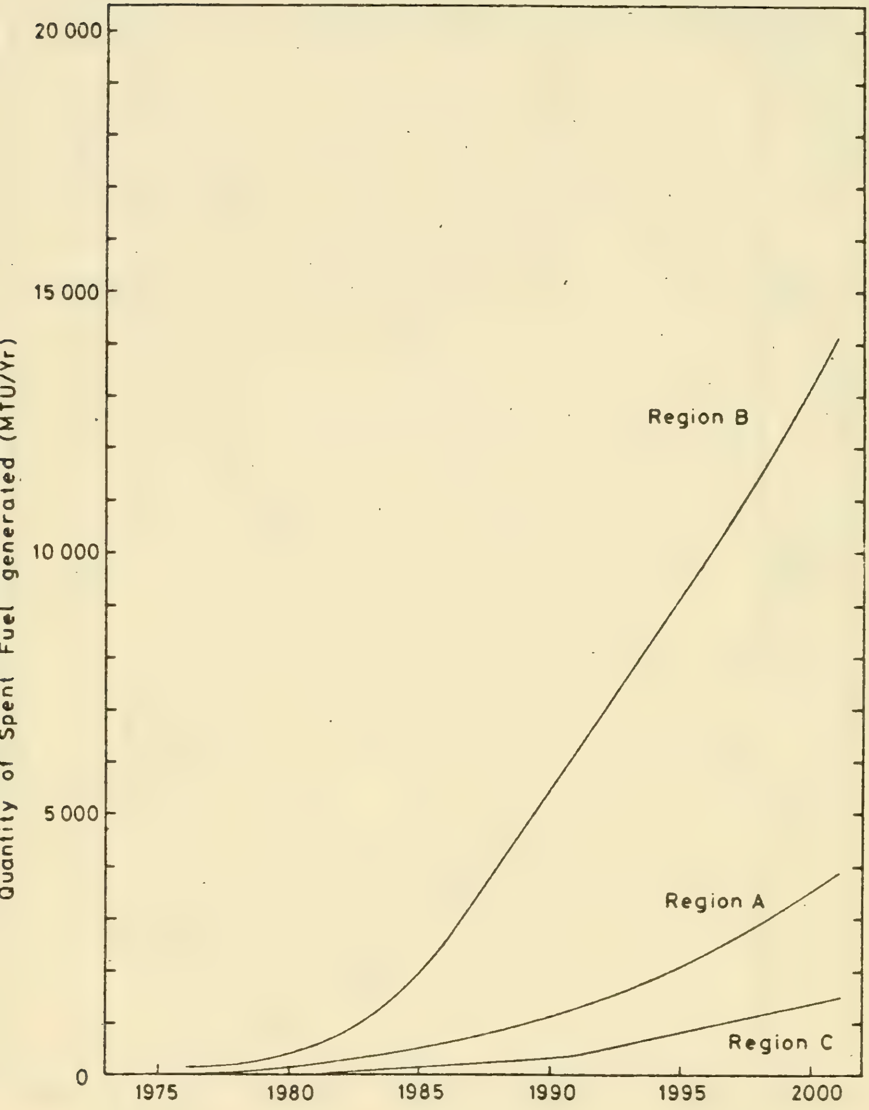


Fig. 7-1 Spent Fuel Storage and Reprocessing Capacity for Region A

—: Strategy 1, ---: Strategy 2

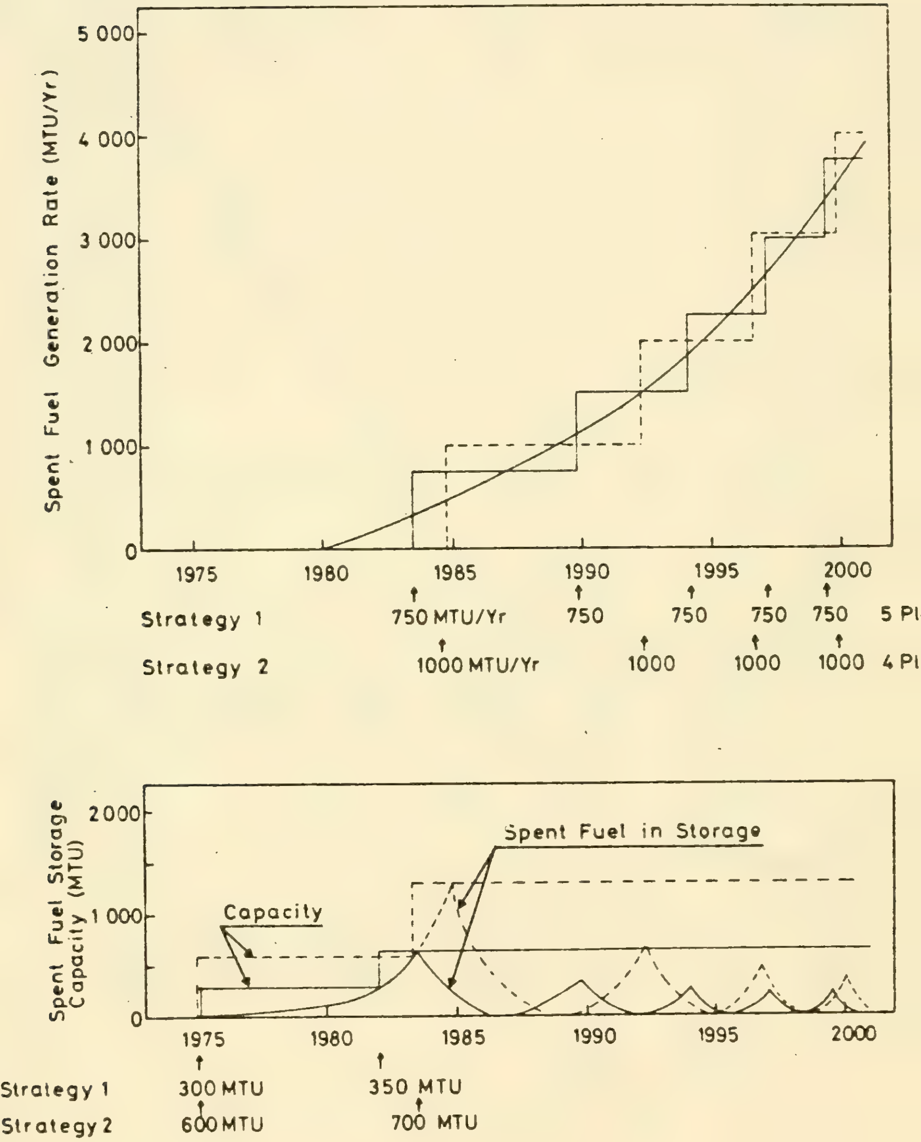


Fig. 7-2 Spent Fuel Storage and Reprocessing Capacity for Region B

——: Strategy 1 , - - - :Strategy 2

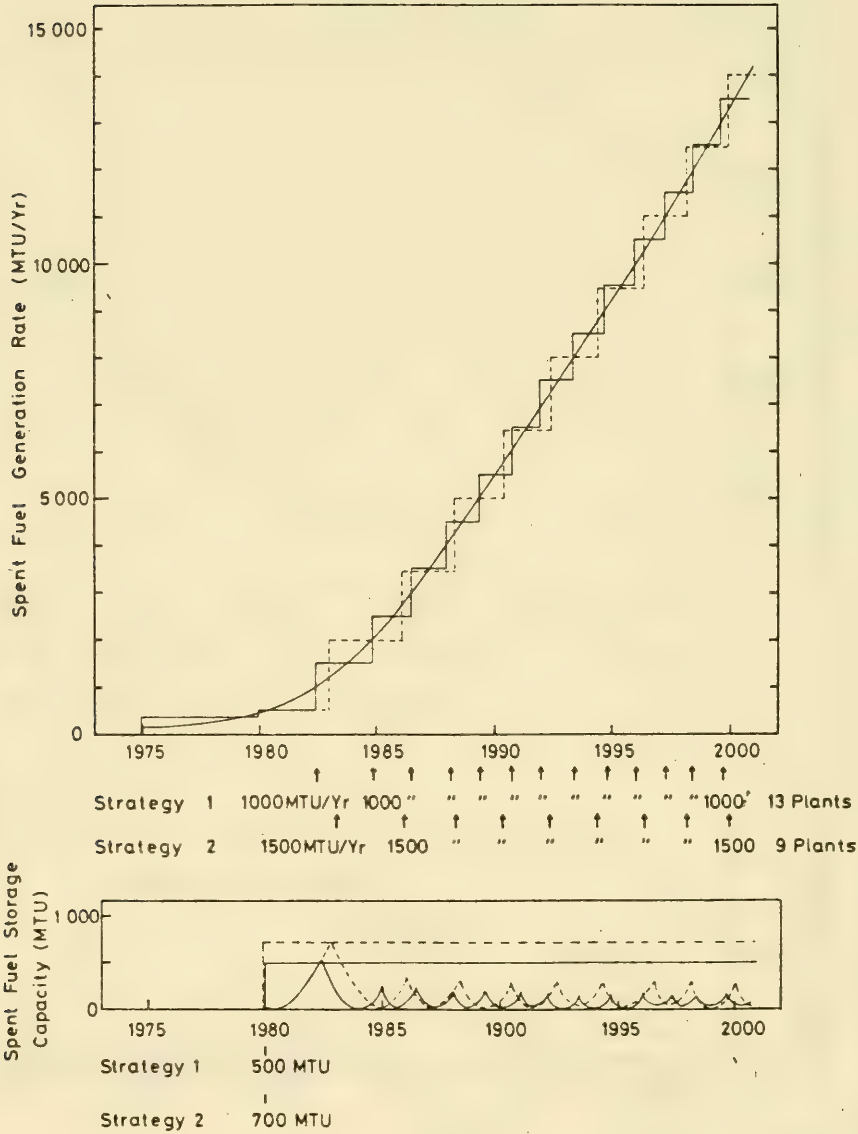


Fig. 7-3 Spent Fuel Storage and Reprocessing Capacity for Region C

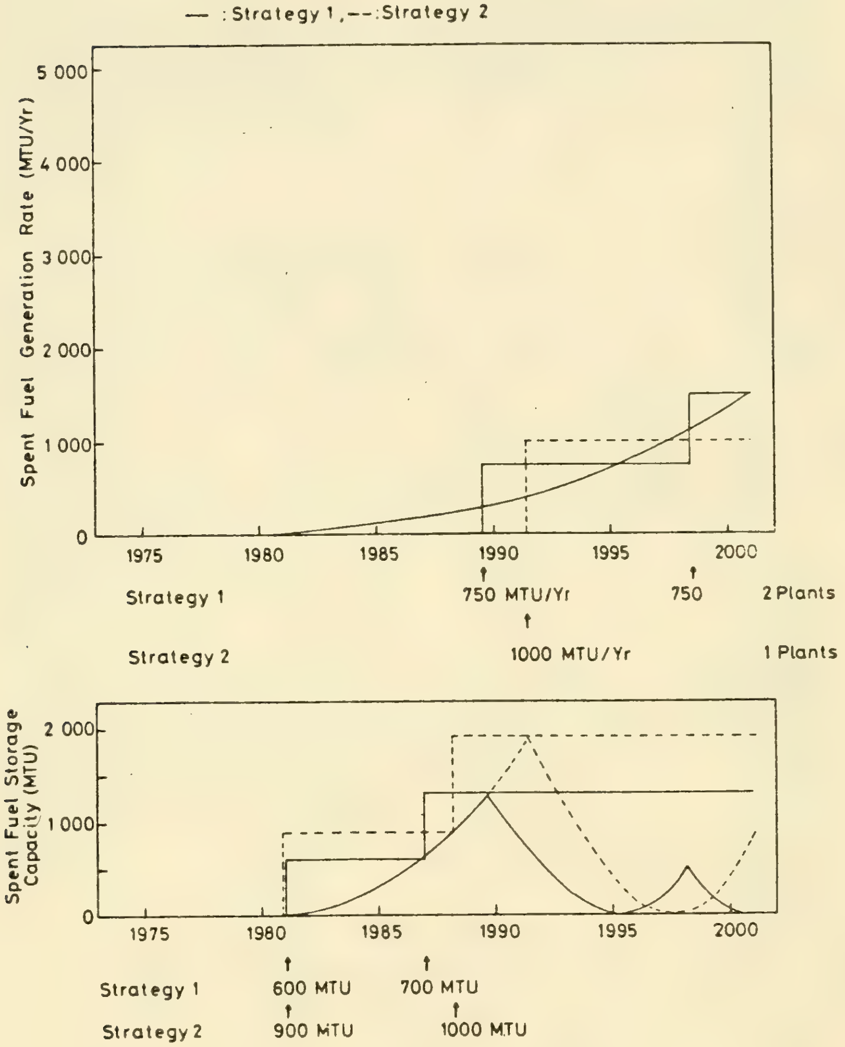


Fig. 8-1 Annual Capital Investment for Fuel Cycle Center for Region B. (for the first two centers only)

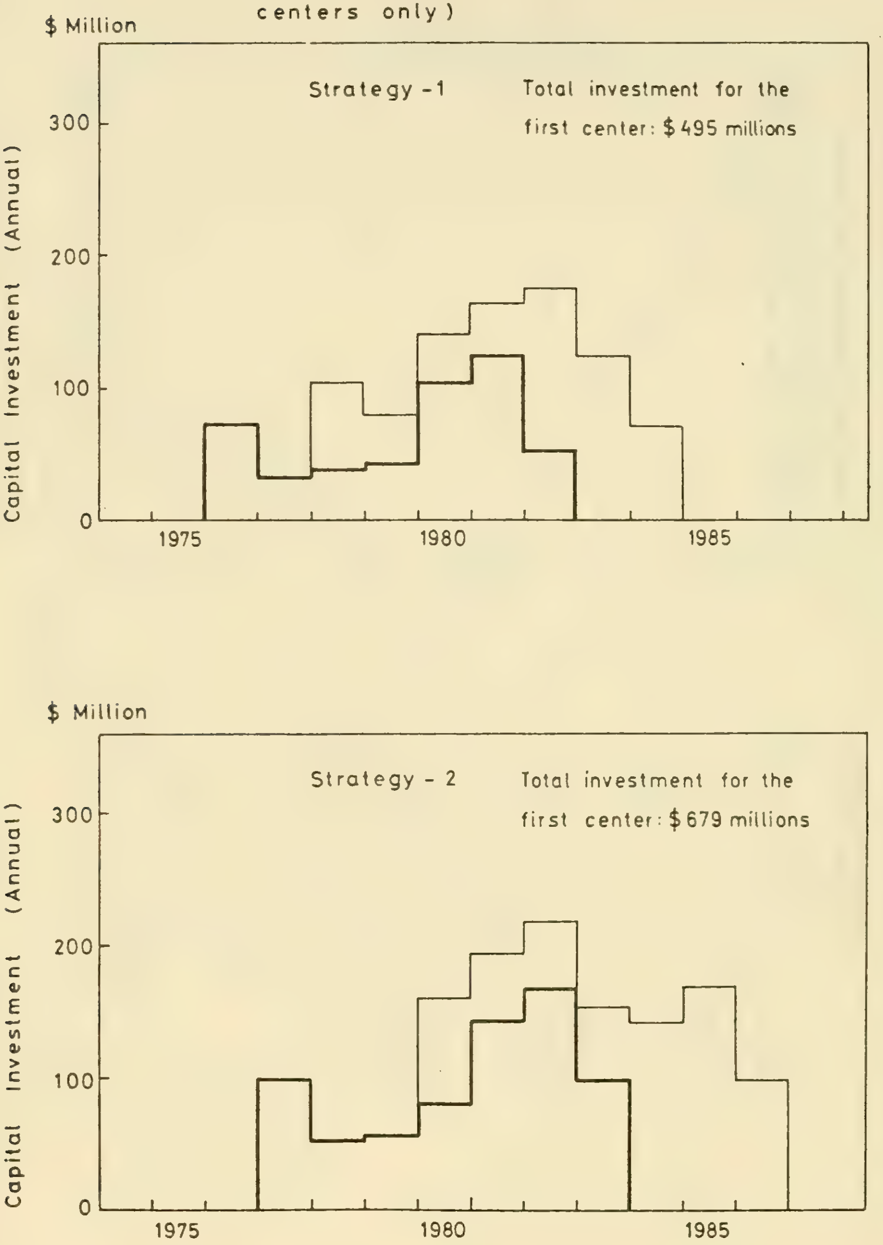
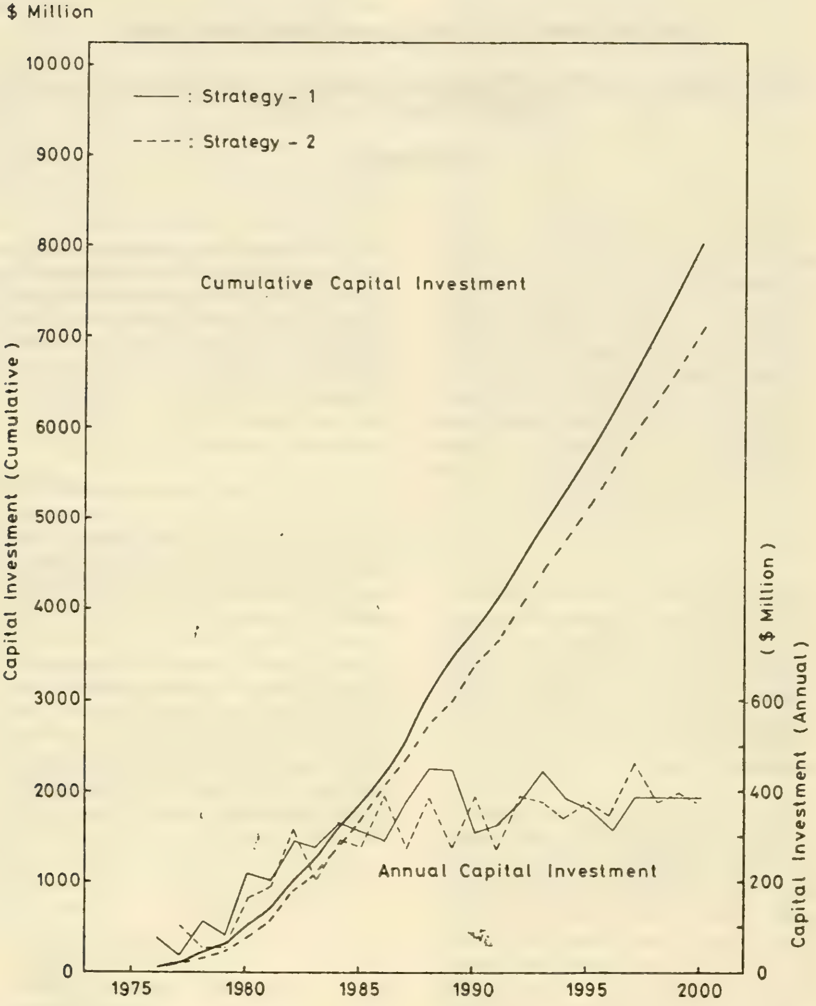


Fig. 8-2 Capital Investment required for Region B

(Annual and Cumulative)



WHAT'S NEW ON NUCLEAR PROLIFERATION?

(A paper prepared for the 1975 Aspen Workshop on Arms Control by George H. Quester, Cornell University.)

FOREWORD

For four summers running, some of the brightest scholars and the most reflective practitioners in the U.S. arms-control community have met in August around a table at the Aspen Institute for Humanistic Studies. Until 1975, these workshops were preoccupied with the limitation of strategic weapons – the bipolar confrontation and the negotiations called the SALT, between the Soviet Union and the United States. One product of these meetings was the landmark volume, "Arms, Defense Policy, and Arms Control", published in June 1975 by ***Daedalus***, the journal of the American Academy of Arts and Sciences.

This year, a consortium has been formed to link the nation's four strongest academic arms-control research centers – at Cornell, Harvard and Stanford Universities and the Massachusetts Institute of Technology – with the Aspen Institute's new Program in International Affairs. This group decided to focus the 1975 Aspen arms control workshop on nuclear proliferation.

The proliferation of nuclear weapons is not exactly new business. The small club of states which developed nuclear weapons naturally wanted to limit their spread; those with the scientific and industrial capacity to develop nuclear weapons had to decide whether it served their interest to join the club. By July of 1975, when the Nuclear Non-Proliferation Treaty (NPT) celebrated its fifth birthday by holding a review conference in Geneva, 96 nations had become parties to the treaty, 15 nations had signed the treaty but not yet ratified it, and 39 nations (including France, China, India and Israel) had not signed it. But adherence to the treaty, a self-denying ordinance, does not close off forever the option of "going nuclear;" nor does non-adherence mean that a nation is determined to develop nuclear weapons. The calculus of costs and benefits in "going nuclear" is complex, and changes from year to year.

That is why, as a necessary ingredient for our August 1975 workshop, the arms-control consortium asked Professor George Quester to review for us what new factors in world politics and economics may affect the motivation of particular countries to join, or eschew, the nuclear club.

George Quester received his doctorate in Political Science from Harvard University in 1965, and has been at Cornell University since 1970, where he served for four years as Director of the Peace Studies Program, and is now Chairman of the Department of Government. He is the author of ***The Politics of Nuclear Proliferation*** (Johns Hopkins Press, 1973).

Harlan Cleveland
Director
Program in International Affairs
Aspen Institute
for Humanistic Studies

NOTE.—This paper has been prepared for the 1975 Aspen Workshop on Arms Control, sponsored by Harvard, Cornell and Stanford Universities, Massachusetts Institute of Technology, and the Aspen Institute for Humanistic Studies. The 1975 workshop is supported by the Alfred E. Sloan Foundation. (Printed by the permission of the author.)

This will be an effort to identify whatever trends are now underway on the prospect of nuclear proliferation. It will not, however, attempt to restate the major background factors that have all along confronted us with a nuclear proliferation problem, i.e. inherent suspicions among nations, the technical doubts about the costs and effectiveness of international inspection, the requirements of national dignity and sovereignty, the potential power of clandestinely produced nuclear weapons, etc. An effort will rather be made to ask what we can say now about the overall international system that we could not have said two years ago, and then to translate this into any implications for the proliferation problem which similarly might not have been so obvious two years back. What thus have been the items of "big news" in the international arena, and what do such items do to the likelihood of further spread of nuclear weapons?

OIL COSTS

Many of us might agree that the biggest single development has been basically economic, in the enormous increase in the price of oil, and the inflation of costs this has produced throughout the world. In a curious way, this seemingly sad fact may contribute to slowing or stopping proliferation, if only in that it makes a number of important nations take energy much more seriously. Japan is a prime example of this effect at work, although similar trends are underway in western Europe as well. At an earlier time, the industrialists and electric power producers of Japan were generally opposed to the signature and ratification of the Nuclear Nonproliferation Treaty (NPT), in fear that the inspection involved would eat away at profit margins, and in hopes that Japan might get away with asserting a more "independent" posture on matters of economics and politics generally. The increase in oil prices has raised energy prices across the board, thus relieving some concern on profit margins. The urgency of finding supplements and alternatives to oil as an energy source moreover has turned these organizations completely around to favor ratification of the NPT. While no specific threats have ever been made, it seems only too obvious that continuous delay in ratifying the treaty can arouse foreign fears of Japanese nuclear weapons intentions, and/or might delay the licensing of American-designed reactors or American-processing of nuclear fuels.

In the Japanese case, the narrowing of economic elbowroom imposed by the rise in oil prices has also had a powerful effect at the broader level of national self-image. Five years ago, one saw a wave of Japanese analysis in favor of new ventures in a more active foreign policy, to be coupled with an expansion of the Japanese Self-Defense Forces which might begin patrolling the sea lanes of the world, perhaps coupled to a retention of the legal option for nuclear weapons. The shock of the rise in oil prices has almost completely terminated this line of analysis, as the Japanese have concluded instead that a low posture was optimal after all, that the economic critical mass for playing some kind of major power role was simply not to be achieved. Some of the same people who looked forward to having Japanese naval vessels off the shores of Kuwait and Mozambique were quietly in favor of Japanese nuclear weapons. For the moment, the mandate for all of this has receded. Whether or not the Japanese Diet yet ratifies the NPT in 1975, for fear of delaying the installation of additional power reactors needed by 1985, the general energy crisis limits how much Japan over the middle term will want to drop its "nuclear allergy."

Similar economic explanations will drive West Germans and other West Europeans to move along quite seriously with their peaceful nuclear programs. At an earlier time, the nuclear energy option was a possibly useful civilian program with an intriguing possibility of military applications. Now it will be a useful and possibly crucial civilian program, which has made all concerned more disposed to acquiesce in NPT ratifications and IAEA inspections to ease concerns about the military possibilities.

Some of such an impact will even show up in places like Brazil, which has shown no signs whatsoever of being in the mood to sign the NPT, but which imports most of its oil, and will also now find its economic growth possibilities constricted and dampened by the change in world prices. Here the proliferation issue at stake is not whether the NPT will be accepted, but what kinds of reactors get purchased, and how much noise gets made about "peaceful nuclear explosives." As in many other countries, one gets a tension and tug-of-war in Brazil between the Ministry of Foreign Affairs (which relishes the national prestige presumably produced by hints of weapons options) and the Ministry of Mines and Energy (which broods about whether energy sources can be found to sustain the economic growth rate of the country). When Brazil in 1970 elected to buy its first power reactor from the U.S., using enriched uranium, rather than a natural-uranium reactor from some other source, this was a victory for those in the country who care less for the prospect of "peaceful nuclear explosives" (the "peaceful bomb") and more for economics. The rise in oil prices clearly has strengthened their hand.

Setbacks of bomb options of this sort are never final, of course; they merely buy us more time. The next round of Brazilian reactor purchases from West Germany, just announced, will again be fuelled with enriched uranium (a good sign), but will be accompanied by construction of a plutonium separation plant and a uranium-enrichment plant (bad signs). Since Germany has become a party itself to the NPT, it will have to require IAEA safeguards over all these facilities, and time may still let us erect new proliferation barriers as older ones lose their punch. Brazil has hardly left "the road to the bomb," and indeed anyone investing in nuclear power necessarily must travel this road. Yet Brazil for the moment is at least not taking the "shortest road to the bomb," and we have the nation's need for additional energy sources as the primary explanation. If United States pressure on West Germany and Brazil moreover extracts more stringent safeguards and more explicit Brazilian pledges (pledges that at least these particular reactors will never be used to produce nuclear explosives), then we again will have the Brazilian energy-appetite to thank for this.

The rise in oil prices is of course still a very mixed blessing for the anti-proliferation front. It may force a number of industrialized countries to be more serious about their options and alternatives, ending the kinds of haggling over alleged grievances that one suspects masked a desire for the bomb. Yet, in other cases, the increased price of oil and energy will fully justify nuclear reactor programs that would otherwise not have been cost-effective. Before oil rose from 2 dollars to 12 dollars a barrel, for example, one could easily fault the Indian reactor program as being cost-ineffective. With the change in prices, the program begins to look like a wise investment indeed, with the Indian bomb turning out to be a very inexpensive by-product.

Some of the more suspect nations, moreover, are not constrained by a dependency on oil imports as Brazil is, and thus will have less belt-tightening to undertake as a result of this major change. Argentina, for an important example, exports some oil, rather than being dependent on imports. While the hands of the economic-growth-minded Ministers may be strengthened in import-dependent states such as West Germany and Japan and Brazil, there will not be such an impact therefore in Buenos Aires.

The relationship between Brazil and Argentina has historically been burdened with tones of invidious comparison and power rivalry, albeit that South America has seen very little in warfare. It is thus unfortunately not surprising to see legislators in each country in 1975 urging moves toward nuclear explosives, on the grounds that such moves are to be suspected in the "rival power."

OIL REVENUES

If the world is having to pay more for oil, the concomitant is that someone obviously must be richer, and the second vector we will thus have to discuss is the proliferation implications of the enormous accumulations of "petrodollars" in the oil-exporting countries.

Considerable attention has been drawn to Iran, particularly because of the programs announced to purchase as many as 20 1000 megawatt reactors to be installed over the next decade, a program which would generate an enormous potential for production of weapons-usable plutonium.

Iran, as a partial counter of reassurance, has signed and ratified the NPT, and all such reactors will thus, as a matter of international treaty commitment, have to come under IAEA safeguards.* This notwithstanding, the world was additionally alarmed by offhand comments of the Shah to correspondents in France. When asked whether Iran intended to follow the Indian explosion with production of nuclear weapons of its own, he was reported to have responded, "Without a doubt, and sooner than one would think."** The interview was subsequently denied, and a full statement indicated that Iran had no intention of manufacturing nuclear weapons, and might only do so if other small powers began producing them. The denial was nonetheless itself somewhat disturbing in that, for its entire length, no mention whatsoever was made that Iran had already made itself party to the NPT, that it had already renounced nuclear weapons as a matter of solemn treaty obligation.

Those suspecting Iranian intentions here will contend that there is no logical civilian purpose for the purchase of so many large reactors at this time, to be accompanied apparently by the construction also of a plutonium reprocessing plant. Iran, after all, is a country with a great deal of work left to do in even the most primary aspects of industrialization, where natural gas is still being "flared" in the oil fields of the country's south (although natural gas from the major fields of the north is now to be piped across the border to the Soviet Union, to replace Soviet gas piped to West Germany). Yet the case is not so clear that Iran is deviating from what is ideal for civilian purposes. The petrodollar countries will have great difficulty in investing their windfall profits so that something useful will be obtained in the next century. Buying real estate in London, or deposits in foreign banks, will solve only part of the problem, for foreign-based assets may be as liable to confiscation in the future as in the past. The installation of power-reactors always takes longer than initially expected, as does the training of the manpower to operate them. The time for Iran to begin such huge investment programs may thus indeed be right now, for natural gas may not be flared by 1988 when the reactors are operating, and Iran may even have industry by then that needs and consumes the electricity produced. If the Shah is serious about his urging that oil be conserved as a petrochemical for the future, that the world cease to depend upon it so much as an energy source, then his investment in reactors may only be the setting of a good example.

More straightforward connections between the collections of oil windfalls and bomb options have been discussed for Libya's

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*For a valuable discussion of the Iranian possibilities, see Anne Hessing Cahn, "Determinants of the Nuclear Option: The Case for Iran" (forthcoming).

**John K. Cooley, "More Fingers on the Nuclear Trigger?", Christian Science Monitor, June 29, 1974.

Col. Khaddafi, who allegedly has been seeking to buy the bomb from Paris or Peking or any other possible seller. Happily enough, there are no signs whatsoever of Libyan success in such efforts, as the Chinese "with politeness" rejected the bid. Khaddafi's control over policy may indeed be in decline. Libya has indeed just negotiated a conventional arms purchase, and a reactor purchase, with the Soviet Union, a state Khaddafi had found obnoxious on theological grounds. The reactor would have to come under IAEA safeguards because the USSR is party to the Nuclear Nonproliferation Treaty. As another surprise, moreover, Libya itself has suddenly ratified the NPT.

One must also note that fabulously-rich Saudi Arabia is one of the two Arab states (Algeria being the other) that has never even signed the NPT; all the others signed, and some have ratified. To close out the oil-riches-to-bombs speculation, there have been discussions in the Cairo press of some sort of Arab consortium organized to develop or buy the atomic bomb, presumably in response to the threat or reality of an Israeli bomb program. This seemingly would mean a somehow-orchestrated combination of Saudi Arabian money and Egyptian leadership.

Some additional speculation on OPEC bomb projects may moreover be inevitable if we see any great deal of further U.S. discussion of a military intervention to seize oil fields to force the price down. The Vietnam experience seemingly had made many Americans conclude that war was always profitless and unthinkable. The energy crisis, however, might serve as the hypothetical counter test-case, wherein it was concluded that war can serve some useful purpose again, if a rapid invasion could somehow capture these most valuable resources before they were irreparably sabotaged. Hints of such speculation had emerged in the fall of 1973 from Defense Secretary Schlesinger, and then, with more world response, in a magazine interview late in 1974 with Secretary of State Henry Kissinger. This was then followed by Robert Tucker's Commentary article of January, 1975 urging military intervention, and several more publications thereafter in a similar vein.

This has all rested at the level of exchanges of waves of speculation, but speculation is what sometimes in the past has pushed nations across the nuclear weapons line. Iranians and Saudis or Kuwaitis might well ask themselves what it takes to guarantee the deterrence of invasion, if the fading memory of the American casualties and failure in Vietnam does not suffice. Elementary strategic analysis might then quickly enough note that nuclear-weapons states never had their homeland invaded, and a pro-bomb argument would emerge.

Iran's case is of course more complicated. Iran has not ever withheld oil as part of any political boycott, but it has been a prime mover in keeping the price of oil as high as it is. Iran classically has feared Russian invasion much more than American invasion, and indeed did not react strongly to any of the "invade OPEC" suggestions emerging in the U.S. after 1973. In Teheran, the extrapolation from Vietnam might indeed be to fear the new American aversion to war rather than welcoming it; what deters Russian conquest of Iran, if there is no prospect of America sending airplanes and troops in response? Again the fears and speculations about the Shah's intentions are at least a little reinforced.

In the case of Kuwait and Saudi Arabia and Abu Dhabi and Libya, the fears and arguments for nuclear moves might be a little more straightforward, as the threat of a Russian invasion is not so tangible.

One grandly optimistic counter to such fears that oil riches will lead to atomic weaponry, would be based on a belief that one or another hidden hand of economic market workings will intervene to keep petrodollars from accumulating. Perhaps the higher prices charged for oil will bring in so many previously marginal producers in Texas and Norway and Ecuador and Britain that the price will have to fall again, or at least the petrodollars will not all pile up in Iran and Saudi Arabia. Or perhaps the inflation triggered by oil prices and other economic events will raise the costs of all the goods the OPEC states import, so that there will be less of a windfall remaining to be budgeted for nuclear programs.

Some of this is happening, to be sure. Yet these trends at best can only trim back the size of the improvement in economic position that has been won by Iran and its partners. If Iran has difficulty in funding all twenty of its planned 1000 megawatt reactors, it may not have difficulty in funding ten. Iran's standard of living and consumption of electricity are likely to remain well ahead of what they would have been if there had been no oil price rise. And Iran's potential for nuclear proliferation will also remain ahead.

FOOD SHORTAGES

The world may be running out of oil. It may also be running out of food. What does one want to make of this international development, often predicted in the past, but almost realized in the past year in West Africa and in India, with the risk of considerably worse recurrences in the next several years? Robert Heilbroner in a book of pessimistic predictions entitled An Inquiry into the Human Prospect* suggested that a nation such as India might indeed feel driven to make nuclear threats to extract food from the richer world, if famine had driven its people to desperation. Are we going to witness nuclear confrontations for food, and further nuclear proliferation as the preparation for such confrontations?

At first glance, the bureaucratic orchestration of this form of "nuclear blackmail" might seem a close-to-impossible task, and one can hardly imagine the "project manager" for this contingency getting all his ducks in a row in New Delhi. Nuclear weapons have not proven so enormously useful for nuclear blackmail in pursuit of any other objective, at least once there was no longer any nuclear monopoly; why should they prove so effective now? Yet this does not dismiss the possibility that this kind of noise in the system can emerge in the next decade, especially if a future famine in India gets perhaps five times as bad as it was this past year. The "trial balloons" of American military intervention for oil cited just above might indeed serve as the perfect model; irrational threats often enough get hinted and leaked, for the threatened party must still worry about whether he should not make concessions to reassure himself that the crazy threat will not indeed be carried through. Even if Americans will never send their sons to fight for the oil-rich sands, the hints of doing so might persuade some of the OPEC states to be more conciliatory. Even if India would never use its peaceful explosives against a nation consuming more than its share of food, unofficial hints of thoughts about such action might persuade Americans and others to impose some food rationing on themselves.

India, after all, can threaten to use its bombs in some less "warlike" ways, for example by threatening to sell some to Khaddafi, because Indian cash reserves were so desperately depleted that it could not afford to buy American grain. Khaddafi's need for the bomb might leave most Indians unimpressed, especially after his record of zealous 1000% Islamic support for Pakistan in recent military encounters. Yet what if the American confrontation with the other OPEC countries ever came to the military crunch hypothesized above? Despite some interesting arguments that American military intervention here would be all to the interest of New Delhi (since it has been the average Indian who most directly suffers from the rise in oil prices), the Indian government would most likely have walled itself in with statements of resolute third-world solidarity; it might then be terribly tempted to take rhetoric seriously and share nuclear weapons with a threatened OPEC state in the Middle East. At that point, of course, the cash bidding price offered by OPEC might also have gone very high indeed.

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*New York, Norton, 1974.

Happily for the proliferation question per se, as one looks around the globe one finds few other states besides India in which famine and nuclear capability overlap. Indonesia over a longer period may accumulate enough technology and capital to make a move for nuclear weaponry, and indeed has made some pro-bomb noises after the Indian detonation. Indonesia has signed but not ratified the NPT. For the moment, the rise in oil prices seems only to be helping Indonesia stave off its problems for a little while longer, as population growth continues to outrace whatever more basic economic progress is made. One could thus imagine the bizarre outcome of Indonesia buying itself a rudimentary nuclear capability (one probably far less well-developed and less well thought-out than India's) while famine closes in.

West Africa for the moment is not going to acquire any great number of reactors. Its sufferings will trouble the world's consciencia, but will not as much worry our sensitivity to nuclear threshholds.

Countries with a famine problem would in any event be a particularly difficult case for an anti-proliferation strategy, for the very precariousness of their situation stands in the way of meaningful outside retaliation. Serious "punishment for the Indians" after their detonation was thus precluded by the vision of starving Indian babies, and of the world outcry which would arise if American or other "retaliation" could be seen as the direct or indirect cause of such agony. Similar problems will arise with regard to "economic retaliation" against any other food-poor state. By contrast, it might be much easier for the powers opposing proliferation to impose economic retaliation if Brazil went nuclear. The Brazilian government has achieved a high economic growth rate, and depends upon this as one of its few genuine claims to popular support. It would be far less unthinkable, and altogether reasonable, for the U.S. and like-minded states to put a crimp in that growth-rate, if the Brazilian regime had made the nuclear move which was to cause such anxiety throughout Latin America.

STAGFLATION

Accompanying shortages of energy and food on the international economic scene has been the quite unheralded development of "stagflation," a simultaneous occurrence of unemployment and inflation which some economists would have thought close to impossible. Whether this is all due to the delayed costs of the Vietnam War, or to the rise in oil prices, or to the creeping guarantees of the welfare state, what does it tell us that we didn't know before about the prospect of nuclear proliferation?

One cannot be blamed for worrying at least a little about the impact of inflation and unemployment in places like Germany and Italy and Japan, or indeed France and Portugal. Are such societies immune to the political responses which afflicted some of them in the 1920's and 1930's? If something that needs to be labelled a "neo-Fascist" response emerges, what links will one find here to nuclear proliferation? Rearmament in Germany seemed a tonic for many ills in the 1930's, letting the Nazis offer a restoration of national prestige and at the same time a relief for unemployment. Could a move to nuclear weapons serve the same role somewhere today?

At the least, nuclear weapons differ from conventional rearmament by not seeming to be as employment-promising. Nuclear weapons are a magnificent gimmick, a grand shortcut to military power. If they ever seemed expensive (the risk for the future is of course that they will seem too inexpensive) they do not seem labor-intensive. As such, one would hope that the political linkage of "let's solve our unemployment problem by becoming a nuclear-weapons state" will never take hold. Public opinion counts for a lot here, as it does all across the nuclear proliferation horizon, and all reports suggest that there is less political sex appeal in nuclear weapons prospects in the advanced industrial countries than there used to be. This has been true in Italy, where officials opposed to the NPT and in favor of Italian bombs have been profoundly frustrated by not being able to arouse any popular response. The same held true in Germany, where Franz Joseph Strauss' CSU has hoped to exploit the nuclear issue in electoral campaigns, and has largely abandoned the question for more promising issues. The more clearly neo-Fascist NPD in Germany has similarly staked out an anti-NPT position, but not given it much billing, simply because voter interest has not shown itself.

Stagflation at its worst can change all this, but most probably would threaten other things we value in these countries before it changed the current disinterest in nuclear weapons. We are indeed witnessing a general boredom with the nuclear topic in most of the world (India being a most significant exception) and this applies to nuclear proliferation, SALT, MBFR, nuclear free-zones, etc., etc.

This author would argue that the world's indifference to nuclear proliferation in and of itself is largely an asset for the halting of proliferation, a moderate spreading of the "nuclear allergy" that allegedly has been such a reinforcement for arms control in Japan. "Weapons-minded rightists" may always be more interested in nuclear weapons than the average voter, but the most important fact may be that voters of every ideological persuasion seem to find nuclear weapons possibilities less fascinating than they did ten years ago. Where this leads to ignorant policy it is bad for arms control. Where it removes one important goad toward national nuclear forces, however, it is good.

It has nonetheless been most important that the NPT be gotten ratified in each of the countries mentioned, West Germany, Italy and Japan, because the remembrance of a solemnly undertaken international legal commitment may be an important reinforcement for nuclear allergies in the future. The German ratification was indeed completed more than a year ago so far as parliamentary action is concerned, and deposit of the ratifications (along with deposit of the Belgian, Netherlands and Luxembourg ratifications) was simply held up to wait for Italy, on the theory that the five affected states of the European Community should act together. One immediate impact of stagflation has thus come with the delay imposed on Italian ratification, as the NPT itself drew little substantive opposition, but as Italy's economic and social ills have made governments so unstable that little serious parliamentary action could be undertaken, no matter how large the support for any particular treaty or bill. The Italian ratification coming in 1975 was at least better than 1976, for the earlier the treaty is regarded as a part of the law, the earlier one would see a final acceptance by many Italians of non-weapons status. But a ratification in 1974 or 1973 would therefore have been better than 1975.

The same holds true in Japan, of course, where ratification of the NPT has also been repeatedly delayed, and where in a more roundabout way (none would contend that Japan's economic ills are comparable to Italy's) the problems of inflation and unemployment have also weakened several governments, making it harder to accumulate the political capital to push through NPT ratification even when the Prime Minister genuinely supports it, indeed even when the representatives of major business interests have come to support it.

The worst impact one might imagine for stagflation is sometimes related to rumors of conspiracies for right-wing or left-wing army coups in Italy. What this would do to respect for a just-ratified treaty renouncing the possession of nuclear weapons is hardly clear, along with what it would do to the political health and equanimity of the rest of Europe.

From the more narrow perspective of fears about nuclear proliferation, perhaps the worst fear should rather be that duly-elected governments in France or Germany or elsewhere will be made desperate for foreign sales to generate employment, and to relieve balance of payments problems, so much so that they will begin selling nuclear equipment to aspiring weapons-possessors around the globe without adequate safeguards to prevent military uses. This can occur at the margin on odds and ends of equipment, as reasonable men will differ as to what is "equipment or material especially designed or prepared for the processing, use or production of special fissionable material," over which the NPT requires the imposition of IAEA safeguards. It can occur more seriously as controls on the supply of reactors and major nuclear equipment become a farce. At the outer limit, of course, one must also consider the technological possibility of France simply selling finished atomic bombs to whoever can pay billions of dollars in exchange. If the alternative were fascism for France or Germany, would not some defender of democracy in these countries be tempted to pay the price?

Happily, the economic forecasts are that inflation should abate while unemployment also abates, after 1975. There are also forecasts that oil prices should begin to fall, as marginal oil producers come into the market attracted by the higher prices. But the economic forecasts were wrong before. Much might thus yet depend on the scruples of the "defenders of democracy" (or are they rather "self-seeking bureaucrats?"), and the priority they might attach to worrying about proliferation in far away places. As noted, there is as yet little evidence that this priority has been high.

POLITICAL EVENTS: "OUTLAW STATES"

Turning away from economics, there have indeed been some major political events in the past two years that were hardly a matter of general prediction. Perhaps the most directly relevant to nuclear proliferation was the outcome of Egypt's and Syria's Yom Kippur War with Israel in October, 1973. Recurrent war in the Middle East has seemed considerably more likely than it seemed in the summer of 1973, given that Arabs have now proved themselves more capable as fighting men, given that the world in general seems now to be politically mobilized against Israel, either in fear of Arab oil power or in genuine endorsement of the moral rightness of the Arab cause. The future survival of Israel today seems more than ever dependent on specific forms of advanced military technology, forms that must be supplied and resupplied by the United States, even when all of the bases in Europe are denied to the U.S. for this purpose.

Will Israel thus, as a result of all of this, be driven across the line to explicit nuclear proliferation? It is clear that there has been a temptation to move closer to that final line of no return. Until recently, it sufficed for Israeli purposes to have rumors merely leak out periodically that the un-safeguarded reactor at Dimona was producing materials for a bomb a year. Anything more explicit, such as a detonation or a specific announcement, would indeed have been counter to Israeli interests, angering the United States, changing the rules of the limited war game in the Middle East when Israel had generally been winning that game. After October, 1973, however, the Israeli winning of that game is hardly so clear any more.

The result of course is that Israeli hints are becoming more explicit, as in the seemingly "inadvertent" statement of President Katzir to a group of visiting foreign physicists that Israel "is in a position to make atomic bombs."

If a conventional military defeat of Israel ever became very plausible, there can be little doubt that Israel would quickly move to assemble and use whatever nuclear weapons it can. While no more than rumors of such weapons were required as an "action policy" before (in a game of political propaganda and political machismo intimidation), more may thus be required if the Israeli situation continues to worsen.

Against this background, one must examine the peculiar happening of the Nixon proposal for the sale of two large power reactors to Israel and Egypt, reactors which would very much have increased electric power production, and plutonium production, in the two countries. The United States has demanded very stringent safeguards over the two reactors, which probably would have made it unlikely that either Middle Eastern state could have gotten bombs from them. Since Israel already is suspected of having extracted bombs from its Dimona reactor, the American proposal might have been seen as enshrining Israel in a position of permanent nuclear superiority, since the U.S. was not demanding any retrospective accounting on Dimona.

Despite this bias in the proposal at the level of material reality, however, the Israeli government through the summer of 1974 seemed less enthusiastic about it than the Egyptian. Even if no bombs could actually be spirited out of the new American reactors, rumors would emerge that they had, rumors which might make Egypt and Israel seem more even in nuclear potential at the level of general psychological image, thus cancelling out what has been a unilateral Israeli advantage.

The very strategic situation indeed establishes a slight bias in favor of the Israelis, where nuclear proliferation prospects are concerned. Israel, threatened with total defeat, simply has more use for "ultimate deterrent" nuclear weapons than any Arab state. What can Egypt do with Egyptian atomic bombs? Deterring the seizure of Cairo is taken care of by the very nature of Cairo. The wildest dreams of a fanatic Zionist expansionist can not really encompass pushing Egypt or Syria into the sea. Arab nuclear weapons might at the margin deter Israeli exploitation of some major conventional victory; but the impact is not at all the same as the role of Israeli nuclear options in ruling out an Arab exploitation of some grand tank battle victory in the Sinai desert. The list of targets that Arab nuclear weapons can be directed at is similarly constricted in a fashion quite asymmetrical to the Israeli target list. Every Israeli city includes some Arab hostages in the immediate vicinity. Jerusalem in particular is a holy city for Muslims as well as Jews and Christians, and thus hardly a plausible target. All of Palestine is indeed what the conflict is about, a prize whose destruction, or saturation with radioactivity, would entirely negate the whole purpose of the Arab effort. For the Israelis to destroy Cairo would have none of the same self-defeating implications.

A second political event of comparable surprise was of course the revolution in Portugal, and the speedy surrender of the African colonies in the aftermath. This has direct relevance to South Africa, which has come to have an extremely parallel position to Israel on the nuclear proliferation possibility and on international political questions in general. The regime in Pretoria was long content to have very occasional rumors and elliptical statements emerge about the potential of its nuclear industry. Being a major source of uranium, South Africa had announced that it was working on new processes of its own for the enrichment of such uranium. South Africa, like Israel, had not signed the NPT. As long as the conventional warfare game was largely in its favor, the Pretoria regime had little incentive to go further than this, since to do so might only have attracted unfavorable world attention, an attention the white regime basically does not want.

With the crumbling of the Portuguese buffers, and the likely fall of the White Rhodesian regime, and the possible loss of South West Africa (Namibia), the conventional warfare picture changes. As in the Israeli case, it may thus seem much more sensible to begin discussing nuclear weapons options openly, and perhaps at some time in the future, to detonate a bomb. The South African regime, like the Israeli, is threatened with extinction. Neither wishes to be "driven into the sea." Each at this stage confronts the problem of moderating the fondest dreams of its opponents. How else, except by acquiring the likely option of nuclear weapons, will Israel convince the Arabs that they must inevitably settle for less than all of Palestine? Total Arab victory, with tanks pushing into Tel Aviv, would now mean the nuclear destruction in retaliation of Damascus and

Cairo and Baghdad and Amman. Sooner or later, the lesson of moderation may begin to sink in. Even now, one begins to see signs of Arab formulas demanding less than all of Palestine.

Similarly, in the African case, how does the white community convince the rest of black Africa that it cannot liberate all of South Africa? If nothing else moderated African demands that Europeans go back to Europe, would not the threat of nuclear weapons directed against major cities do the trick? One might stress here that the role of nuclear weapons options in each case begins well before any serious fighting begins. One is almost as much interested in deterring or limiting expectations as in deterring specific actions.

In South Africa one thus sees the beginning of the same asymptotic approach to the nuclear weapons line as in Israel. This is interspersed with simultaneous moves to moderation and positive appeasement. While Prime Minister Vorster talks of the possibility of "dismantling Apartheid," the South African Army Chief of Staff makes the comment that, "The outside world of course expects us to make nuclear weapons if we are militarily threatened."

There is unfortunately yet one more state in a very similar position to Israel and South Africa, rendered an "outlaw" by its treatment at the United Nations and in other forums of international law, and thus plausibly contemplating an acquisition of nuclear weapons to reestablish an unassailable claim to sovereign status, a buffer to being driven into the sea. Nationalist China's fall from international grace is not news of the past two years, but began some five years ago. Yet there is nonetheless now again a perceptible acceleration of American desire to make concessions to the Peking regime, with Democratic Presidential candidates from Jackson to McGovern suggesting that full recognition be accorded the Peking regime; if this happened, the American Embassy would be withdrawn from Taipei.

Nationalist China, unlike Israel and South Africa, has signed and ratified the Nuclear Nonproliferation Treaty. Yet since "China" had the atomic bomb as of 1967, the date at which the NPT freezes the nuclear club, Kuomintang and other international lawyers might not so unreasonably argue that Taipei had not renounced nuclear weapons by signing the treaty, any more than Britain or the USSR or the U.S. had renounced them. As a matter of law, the whole world recognizes that there is only one China, while differing as to which is the regime governing the country. The NPT limits the number of countries allowed to have nuclear weapons, without getting into the issues raised by changes of regimes. If all the Chinese atomic bombs of 1967 were in the hands of some Communist bandits on "the mainland," this does not legally alter the KMT's claim.

In any event, Taiwan has some reactors to produce plutonium, and has set up a small-scale plutonium reprocessing plant. For the moment one simply hears rumors, inspired by someone, that there are Taiwanese moves toward nuclear explosives. As in the Israeli case, too explicit a move to nuclear weapons might prematurely alienate the United States. But if the United States is intent on abandoning Taiwan, or simply forgetting it, there may yet be more public announcements of a Taiwan-controlled bomb, or even a detonation.

The Taiwan legal question is tied in with proliferation issues in several ways. Nationalist China was expelled from the IAEA. Does this terminate the legal basis for IAEA inspection of reactors on Taiwan? Peking has indeed declined to take its place in the IAEA while activities of that Agency on Taiwan are maintained. American safeguards would as a fallback cover some of the bigger reactors under construction on Taiwan, safeguards which will remain in place even if IAEA activities are terminated. But a smaller Canadian reactor is sufficient to produce material for a bomb or more a year, and this has all along had no provision for Canadian safeguards if IAEA's were terminated; indeed Canada does not in any way recognize the Taiwan regime anymore.

For the moment, the Peking regime has avoided making any vocal demands that its preconditions for taking its rightful seat in the IAEA be satisfied; this may show that the Communists are indeed aware of the advantages of retaining IAEA safeguards over the reactors on Taiwan, lest the KMT regime be free to produce plutonium bombs. Peking may never be able to endorse such "compromises of its sovereignty" openly, but may do so tacitly.

The KMT regime on Taiwan decided not to send a delegation to the NPT review conference, probably thus avoiding a debate on its right to attend, a debate which might well have led to exclusion. This may have been simple cooperation with the goal of keeping the Review Conference and the NPT as a whole on a positive track. Yet it might also be suspected of paving the way for Taiwan to declare itself once more unbound by any provisions of the NPT.

MICRO-PROLIFERATION

Apart from the example of three political regimes which have in effect been made into "outlaws" by their ouster from the international community, the world in the past two years has become much more sensitive to a very different kind of "nuclear outlaw" menace, the emerging risk that bombs may be stolen and acquired by political extremist movements, or even by venal criminal syndicates such as the Mafia. This can occur if plutonium or enriched uranium is stolen from nuclear power plants. It can occur also if finished nuclear warheads are stolen from stockpiles of the U.S. Army, or from arsenals of any one of the other nuclear-weapons states. A similar form of extremist or criminal leverage can be created if large power reactors turn out to be very vulnerable to sabotage, for example, releasing large amounts of radioactivity into the air after being hit by any sort of conventional rocket fired from a short distance away.

What does this new turn in the form of the proliferation problem do to the likelihood of nuclear proliferation in general? In several ways, we may extract some help here, as governments discover more of a common menace to themselves, a common menace which may slow moves toward acquiring nuclear weapons for national arsenals, and may even slow investments in peaceful nuclear projects.

Countries plagued with extremists, and/or with unreliably subordinate military forces, may thus think twice before deciding to place nuclear weapons into precarious arsenals. How could the rulers of Argentina or Egypt be certain that such weapons would not soon be used as an enormous lever against them? Even the vision of a large reactor sitting upwind from Cairo might make an Egyptian ruler think twice, if this gave the PLO or Black September one more way of holding Cairo hostage to support its most unreasonable and intransigent demands.

The greater volume of terrorism which we have seen executed and tolerated in the past two to ten years generally makes life less pleasant in the world, and, as noted above, makes us worry all the more about nuclear proliferation. Yet "every cloud (even a mushroom cloud?) has a silver lining," and in some bizarre ways the incidence of terrorism may thus even slow proliferation here and there. An instance of more direct impact may be occurring in Argentina, where the staff and operations of the Atomic Energy Commission are reported to have been substantially upset by the changed political style of the country since the first return of Peron. While the presence of a number of Argentinian physicians in Iran has caused some alarmed speculation about a joint bomb project for the two countries, it may instead simply reflect these Argentinians' strong desire now to find employment outside their country. Argentina has already seen one example of "nuclear terrorism" as the atomic power plant under construction at Atucha, some 60 miles north of Buenos Aires, was temporarily seized and held by a Trotskyist urban guerrilla group. If the nuclear physicists of a country become sufficiently fearful of, or alienated from, the rest of the country, some of the "inherent" impetus "to make bombs for one's fatherland" may yet be muted.

The threat of nuclear theft and nuclear terrorism may yet over time drive the governments of the world to take their common interest more seriously, and thus to reduce the stress on international conflict. French statements on the NPT had typically argued that a "compromise of sovereignty" was involved, that the treaty served the interests of the superpowers and not of the nations at the threshold. The French tendency to abstraction here as elsewhere has done damage to the subtlety of the arguments, and also to the prospects of a more peaceful world. In the last year, however, there has been evidence of a genuine concern in Paris about nuclear theft, a "threat to sovereignty" indeed. The abstraction of French reverence for the legitimate state thus also now makes for a considerably greater revulsion at the idea of nuclear weapons in the hands of the IRA or PLO, not to mention the Breton or Basque separatists. In May of 1975, France indeed also experienced a preliminary incident of "nuclear terrorism," as bombs were detonated at the construction site for a nuclear power station, allegedly detonated by a "Meinhof-Puig Antich Group" of anarchists.

This all gives the supporters of the NPT and of parallel barriers to nuclear proliferation a more convincing and less insulting argument. The further spread of nuclear weapons need not be condemned because "nth" nuclear powers are inherently less to be trusted. Rather one can stress that proliferation to countries will risk proliferation within countries, a danger to every government and not just to the vested-interest superpowers.

The United States can state this argument most meaningfully of course, by getting its own house into order, for the largest flow of plutonium at the moment is within the U.S., and recent studies suggest that this flow has not been adequately safeguarded against ordinary theft. Since officials of foreign Atomic Energy Commissions and electric power companies regularly must visit American facilities, a tightening up of security procedures would be instantly noticeable, perhaps inducing more than a little disquiet where procedures have been too sloppy also abroad.

The International Atomic Energy Agency, charged under the NPT with the task of guarding against diversion from peaceful nuclear projects into military programs, might well be used as a means of disseminating technical suggestions and advice on improvements in security, advice which can become very welcome if the anxieties are served as sketched out above. Over time, the world's view of the IAEA might thus come to include some of the image of cooperation that now arises in Interpol, to dilute the "adversary watchman" image that arose during the NPT debates. Foreign inspectors who make life easier for domestic bureaucrats are typically more welcome than those who simply make life harder. The IAEA already has a "cooperative" task in supplying technical assistance in nuclear matters, and the common risks of nuclear theft might over time make this cooperative segment of the role grow. This can indeed happen even if domestic security matters are never formally added to the Agency's role, for even the informal transmission of helpful hints on better locks and less foolproof bookkeeping may be very welcome.

THE INDIAN PRECEDENT

The reader of this discussion of the past two years' "political events" might at this point protest that the most major relevant event has scarcely been mentioned, the Indian detonation of a "peaceful nuclear device" in May of 1974. One can hardly deny that the example and precedent of the Indian move creates problems everywhere for stabilizing the number of nuclear weapons states. Yet at the same time one might reject some of the more pessimistic analyses that emerged immediately after the Indian detonation.

Things would have been worse if the states resisting proliferation had in effect bet all their chips on stopping India, making New Delhi the firebreak, the one test case upon which all further credibility depended. Happily or unhappily, this was not the case for the years preceding the Indian move. It was fairly obvious that the U.S. and USSR, but also many other nations as well, had come to see India as a sort of special case, likely to defy the outside world in rejecting the NPT, and very possibly also in making atomic bombs. The nearness of China, the size of India, the advanced state of Indian nuclear industry, all suggested this.

It is certainly true that the American and Soviet failure to respond negatively after the Indian detonation casts more than a little doubt on superpower resolve and menace here. Yet the conclusion that Washington and Moscow are "paper tigers" is less clear when the preliminary suggestions are allowed that India might be a special case. To not resist at all raises doubts; to resist and fail raises more doubts. As things stood, a concerted and serious effort from 1967 to 1974 to dissuade India from going nuclear might have succeeded, but might have failed abysmally. Perhaps worst of all, it might have failed as Moscow and Washington very visibly double-crossed each other, with each rushing to win Indian favors by being the first to abandon whatever sanctions had been undertaken.

Our basic task probably is now to persuade the world that a stable nuclear club of six, rather than five, has been established. Earlier it might have made sense to tell the Indians that any "sixth" would quickly lead to the fifteenth. But it would be foolish to believe this ourselves now, or to tell it to the Indians anymore, for it quite needlessly would be to let a pessimistic self-confirming proposition be fulfilled.

For whatever reason, the efforts of the NPT supporters will now be directed to quietly coopting India into becoming a silent partner in stopping further proliferation. The model here might be France and China, which have indeed criticized the treaty publicly, but not sabotaged or upset it privately. If India can be persuaded to detonate relatively few such devices in the next decade, and to direct relatively little publicity to such detonations, this will help stop further proliferation. If New Delhi can be persuaded to stick to its euphemism that its bombs are actually "peaceful," so much the better also. Alarm has been expressed at Indian willingness to cooperate with other aspiring nuclear-weapons states, in particular Brazil or Argentina, with whom "nuclear cooperation" agreements have been signed in recent years. Yet the fine print of these agreements specifies that they are limited to "non-classified" matters, and all information on explosives within the Indian Atomic Energy Commission is "classified." It will help if India can be gotten to stop signing and publicizing such agreements, which indeed are mainly showcase items dating back to the tenser periods of Indian defiance of Moscow and Washington on the NPT. Yet it will also help if we as Westerners always first read the fine print, and not spread premature alarms about conspiracies among bomb-makers.

Apart from the general precedent set by India, one must of course also brood about specific dominoes, specific linkages, since India has not had happy relations with all of its neighbors.

Pakistan is clearly a problem, as it will very much want to acquire a nuclear weapon of sorts to deter and balance India's. Yet the obviousness of the enmity and parallel here will put potential nuclear suppliers very much on their guard. This will be true to a degree that is indeed most unfair to Pakistan; if India had not detonated the bomb, Pakistan might find it easier to buy advanced reactors today. It is a little like what would happen on sales to South Korea if the news had just come in that North Korea had detonated a "peaceful explosive."

There is thus no reason to expect that Canada will repeat the mistakes it made in the Indian case, or that the U.S., USSR or Britain will be easy-going on sales there. France, despite its protested indifference to nuclear proliferation questions, may also not wish to jeopardize its relations with India, if nothing else mattered. Classically, suspicions have been directed at Peking, taking quite literally the earlier Chinese protestations that nuclear proliferation was a good thing. Yet all indications are that the Chinese have never privately encouraged Pakistan to expect nuclear weapons after India got them (or encouraged Egypt vis-a-vis Israeli nuclear weapons), and Peking has very much soft-pedalled its public endorsements of proliferation since the mid-1960's. The clearest indicators of this in the last year came with Chinese endorsements of the Shah of Iran's proposal for a Middle East Nuclear Free Zone, an imprecisely defined zone which probably does not include India, but very probably is meant to include Pakistan.

However much the Chinese might welcome revolution abroad, there have been clear signals that Maoist thought does not sanction revolutions based on technological gimmickry, for example, via hijacking airliners. Perhaps the stress on indigenously-based revolution is pure window dressing, but perhaps it instead reveals a real fear of revolutions facilitated and controlled from abroad, in the aftermath of China's own escape from being a satellite of Moscow comparable to Bulgaria.

We could thus venture one generalization yet, which the facts of the past two years seem to be confirming rather than disproving, that the nuclear-weapons states of the world continue to be close to unanimous in opposing proliferation, at least at the level of actions that matter, as opposed to positions taken pro forma at the UN General Assembly.

If the first five nuclear powers are not going to give Pakistan the bomb, the "sixth," India, is of course not going to do so either. To move beyond the patently obvious, moreover, it is hardly clear that New Delhi will be generous or careless with any other nation in giving the bomb away. Despite all New Delhi's ritual denials that there was anything wrong with nuclear proliferation, the professionals of the Indian Foreign Ministry and Atomic Energy Commission are well aware that it might be optimal for India to close the nuclear club's membership list at six. India will say this no more openly than China has said it, but one can hardly doubt that the arguments are understood in New Delhi.

One major political event not predicted two years ago was of course the suspension of democratic government in India. What will be the impact of this on India's nuclear policies? Mrs. Gandhi might of course feel driven to win domestic approval and to divert foreign criticisms by embarking on a more aggressive foreign policy, perhaps even brandishing her nuclear potential or becoming incautious about sharing it. Yet the opposite tack is equally possible, that India's government will now try to avoid unnecessary foreign attention as much as possible, and thus hold nuclear tests and nuclear speculation to a minimum. In one peculiar respect, the unhappy events in India may be of help in discouraging proliferation. Mrs. Gandhi's assumption of emergency powers may have replaced the nuclear tests in the world's eyes as "the latest news out of India." It may also have made India generally a less interesting country; at one time it was the "world's largest democracy" or the "only major democracy in the less developed world," but it is no longer.

In terms of material potential for matching the Indian detonation, Iran may be more of a problem than Pakistan, in light of all the reactors it is contracting to buy. For a time it indeed seemed that relations between Iran and India were moving toward a military confrontation in the decade, as the Shah had proclaimed his intention to defend Pakistan against Indian or Afghan attack. The months before the Indian detonation fortuitously saw a detente however, as Mrs. Gandhi visited the Shah in Teheran, perhaps as India assured Iran that it had no intention of dismembering the remaining West Pakistan. Yet tensions of this sort come and go, and come again. If Indian expansionists were tempted by unrest in Baluchistan (on the Pakistani-Iranian border), or if Pakistani soldiers proved so brutal in suppressing such unrest that the outside world's moral feelings again sanctioned an Indian intervention as in Bangladesh, the Shah of Iran might feel driven to augment his arsenal as quickly as possible for a new confrontation with New Delhi. Similar consequences might appear if India and Iran became locked into some sort of irritating "naval arms race" in the Indian Ocean, or into a dispute over sovereignty or a naval base on some island in that Ocean.

Above all, there is as yet no denying the momentum implications of the Indian detonation. We may be able to absorb the shock of New Delhi's move by itself, but the tolerance and margin for absorption for any additional nation's detonations has now been largely depleted. The impacts of a Brazilian detonation, or an Israeli detonation, or one in Indonesia, will thus be much more damaging than they would have been in 1973, simply because the world's opinion will couple it to that in India, to extrapolate some sort of irresistible "wave of the future." This is the kind of momentum that can be diminished or dissipated if only enough of an interval can be kept between events. If the next nuclear detonation occurred only in 1984, therefore, there might be much less of this kind of "wave" interpretation for much might have happened in the meantime to make such linkages seem altogether less relevant.

QUESTIONS ON U.S. CREDIBILITY

Are there some additional political developments that could not have been predicted two or three years ago that shed light on the likelihood of nuclear proliferation? One, of course, is the rapidity of the collapse of the Thieu regime in South Vietnam, with the United States doing little more than the evacuation of refugees. Secretary Kissinger has suggested that this all stems from the Watergate crisis which drove President Nixon from office, indeed a major event not yet predicted in 1972. The Congress during the Watergate Crisis enacted legislation precluding any resumption of the B-52 bombings of Hanoi, the Vietnam war "deterrent" closest in function to the role of nuclear weapons. How many more dominoes are threatened, besides Cambodia, Vietnam, and Laos? If Thailand and Malaysia and the Philippines are beset with new waves of guerrilla warfare, does this somehow develop a link to nuclear proliferation? Nuclear weapons may be totally unconvincing as a counter to guerrilla ambushes, but they might be more plausible as an instrument of deterring retaliation where large-scale tank attacks and artillery barrages are involved, as indeed they were in the final North Vietnamese victory against Saigon.

When the U.S. "deterrent" of B-52 raids against Hanoi had been eliminated by the Congressional action of 1973, Saigon happily had no option of replacing this with some sort of nuclear threat against Hanoi. Yet our proliferation linkage would less happily be reactivated if we found some regimes around the world more able to reach for this kind of deterrent, regimes now fearful that American deterrents will similarly be pulled out of the scene in the future.

We have already mentioned the fact that Iran has all along had to deal with the question of "what prevents Russian tanks from entering Teheran." In the immediate aftermath of the Vietnamese events, the Shah was so kind or so plucky as to say that there need be no reflection on American resolve, that the U.S. could not be expected to defend a country whose army lets so much of its equipment fall into enemy hands in pristine condition. Yet "whistling a happy tune" is not always proof that one is not afraid.

Some immediate symptoms are more disquieting in Turkey, Iran's neighbor to the west, where ratification of the NPT has been shelved and statements have been issued that Turkey contemplates acquiring nuclear weapons. This may again reflect some general questioning of American commitments against Soviet aggression, or a more particular pique after the American Congressional response to the Cyprus invasion.

Others brooding about a diminished image of American commitment after the Southeast Asian debacle might be more quickly drawn to the analogies between South Vietnam and South Korea. The Republic of Korea has just completed ratification of the NPT; but this comes almost a little too directly after an American Congressional outcry against the contemplated sale of substantial amounts of enriched uranium to the Koreans for use in power reactors. When acceptance of the treaty comes so closely in the face of outside pressure, one may be less reassured of the regime's intentions. When the regime is as independent of public opinion as the governments of South Korea or Iran, moreover, one derives much less reassurance that a signature or ratification of the treaty will have produced some new aversion to nuclear weapons that had not been obtained before. An NPT ratification in Australia or Italy increases the aversion because of the sense that the nation has made a solemn international commitment; much less of such a commitment is sensed when the nation is not really consulted. Despite the NPT ratification, will we thus see Seoul seeking to equip itself with a nuclear deterrent for fear that the United States is about to withdraw any tactical nuclear weapons it may have kept deployed in South Korea, for fear that Americans by the Vietnam analogy would no longer be prepared to invest infantrymen or conventional-bombload B-52's in the deterrence or repulsion of a North Korean attack? President Park unfortunately let himself give several press interviews in the spring of 1975 in which he opened just such possibilities.

Much will inevitably depend on what "lesson" is learned from Vietnam. Did the Saigon regime fall because it was incapable of rebuffing the techniques of guerrilla war? If so, did the effectiveness of guerrilla methods mostly reflect one aspect or another of the indigenous situation, or can they be infinitely reused down the rows of falling dominoes?

Did the Saigon regime's army crumble rather in the face of a classic tank and artillery attack? Is the potency of armored attack thus something that can be used again and again, or was it dependent peculiarly on the geography of the perimeter that Saigon was striving to defend, a thin slice of territory prone to be sliced into pieces whenever the opposing side marshalled its forces properly? The world has now seen tanks used to some effect in four separate instances over the past three years, in Bangladesh, in the Middle East, on Cyprus and finally in Vietnam. Yet Bangladesh and Cyprus illustrate geographical anomalies just as strong as that in Vietnam, geographical dispositions along the lines of confrontation that very much favored one side to win if it made an offensive military move.

And the Middle Eastern war remains quite difficult to sort out for lessons about offensive or defensive trends. The tank showed that one could cross the Suez Canal (in both directions), but may in later days of the war have shown itself to be surprisingly vulnerable to precision-guided anti-tank weapons, weapons which can be carried by ordinary infantry and which might favor the defense. The war in the air similarly had periods in which defensive weapons seemed in the ascendancy. Great-power interventions heavily influenced the ebb and flow of the October War, and might make it difficult to predict blitzkriegs or stalemates for the future.

Are we moreover seeing a sort of general resurrection of the utility of conventional military attacks, as the world is ready to tolerate "smash and grab" aggressions, as threatened nations will thus have to match this with a resurrection of interest in nuclear deterrents to prevent such conventional attacks? Yet aggression was made easier and more palatable in several of these cases by the obvious desire of the Bengalis and Turkish Cypriots to be liberated by the tank forces rolling in. This author does not find the preferences of the Vietnamese people to have been nearly so obvious, but the world's tolerance for armored aggression there had obviously increased when a guerrilla war had been devastating the countryside involved for decades, leaving less of a "status quo" to defend. One knows little about whether any indigenous people still live in the territories the Egyptians succeeded in wresting from the Israelis by the tank attack in the western Sinai, but the moral attitudes of the world clearly are settled in believing that this territory "rightfully belongs to Egypt."

There can thus as yet be little consensus about what the Vietnam ending proves about the world's vulnerability to conventional or guerrilla attack, and about what this will do to enhance or weaken the appetite for nuclear weapons. For reasons quite unrelated to nuclear proliferation, one might hope that the attractiveness of taking the offensive will decline all across the military spectrum. At least this is the corollary if one strongly desires peace; partisans of a "speedy liberation of Thailand" might have other preferences. Narrowing the focus to the impact on nuclear appetites, it has been argued in this paper that fears of terrorism and guerrilla war may actually slow nuclear proliferation, while fears of tank attack may accelerate it.

SUPERPOWER DOMESTIC POLITICS

To shift to the opposite end of the scale on the magnitude of political happenings, are there any new forms of bureaucratic behavior to be noticed now that we might not have anticipated, behavior which politically has some fallout for the proliferation problem? Unfortunately there are, in a remarkable resurgence of Soviet support for peaceful nuclear explosives projects within the USSR and abroad, just at a time when American experts were increasingly being forced to admit that all such projects look dubious, just when the Indian euphemism has demonstrated how these projects can be used as a cover for weapons projects.

The enthusiasm for such projects hardly grips all of the Soviet decision-making apparatus; persons involved in the evolution of the NPT, and in arms-control discussions in general, can still be gotten to admit feelings that the whole peaceful nuclear explosives project should be abandoned. Yet the ups and downs of bureaucratic infighting and empire-building in the Soviet Union are coming more and more to resemble what we are used to in the United States, and for the moment it seems that those who have wedded their careers to such ventures have captured some ground. This showed up most strikingly in the composition of the Soviet delegation that negotiated the proposed Comprehensive Test-Ban Treaty in the dying days of the Nixon Administration, a treaty which clearly invites ridicule and antagonism in the nuclear threshold countries. Largely at Russian insistence, the draft of the treaty imposed no ban at all on testing of peaceful nuclear explosives; when this was combined with the general tolerance of tests below the level of 150 kilotons, the treaty hardly amounted to a moral blow at the Indians after their "peaceful" detonation. Projects are apparently moreover being promoted within the USSR for a large number of nuclear detonations to reverse the course of a river, to make it flow south instead of north and thus to replenish the Caspian Sea, again a plan which all in all will make nuclear proliferation easier around the world behind the "peaceful shield."

We are used to attributing excessive coordination and discipline to the Soviet system, this presumably being an ingredient that has been of advantage in the frays of the Cold War. On one of the most important "post-Cold-War" issues, however, we now see an uncoordinated and internally counterproductive Soviet apparatus, attacking Brazilian projects for "peaceful explosives" in one breath, and making them easier in another. How these issues will be resolved within the USSR is hardly certain, and individual Soviet arms control scholars have admitted that they wished it would be resolved soon. Persistence of the discord increases the likelihood of further proliferation.

Discussions of internal politics and bureaucratic infighting brings us fairly quickly back to the familiar terrain of the United States. Here also there are many unanswered questions, albeit not so many surprises for the past two year period, since the questions had no clear answer in 1973 either. How much do President Ford or Secretary Kissinger worry about nuclear proliferation, or care about the NPT? Given a decision-making style where everything seems to depend on the scarce resource of the Secretary's personal attention, can we be at all clear that the Indian detonation really alarmed him and captured more of his attention? Is the quiet soft-sell approach that has governed American policy for the past seven years merely a rationalization for doing nothing at all, or is it the low posture that is the best posture?

There is indeed an interesting argument that the low posture is the best approach to selling the NPT and discouraging nuclear weapons options. Keeping the world bored with nuclear weapons may be an elementarily good anti-proliferation strategy, and keeping NPT and nuclears out of the news may be the best way to go about it. Supporters of such a policy may thus be unfairly burdened with an impossible task, when asked to explain or explicate what the U.S. is doing to slow down proliferation; if the tactics could be seen, they wouldn't work. Perhaps soft-sell explains why Germany and Italy ratified with so little uproar, when many had feared these would be the core of the opposition.

Yet another political development can create serious hardships here, as the U.S. Congress may no longer sit still for such a quiet and hidden approach. Observers have been predicting for many years that Congress would take a more active role in foreign policy. Congressional interventions on Vietnam indeed came later than predicted, and other interventions may have been postponed by a general respect for the talents and efforts of Henry Kissinger. Yet the respect for Kissinger is now obviously in some decline, and the mood of the Congress may be to retain greater influence on the issues. When this is combined with a substantial turnover in the manning of the Joint Committee on Atomic Energy, and some further uncertainties as to that Committee's future role, our range of unpredictability is widened.

Congress has some advantages and some drawbacks as a tool of foreign policy. One drawback is the dilletantish and overreactive style of Congressional policy, exemplified perhaps by the bans on weapons sales to Turkey. The new Congressional interest in nuclear matters is thus suddenly providing threats of explicit cutoffs of nuclear assistance directed against nations which refuse to ratify the NPT or which move uncomfortably close to the bomb; this may inspire good behavior in some foreign countries and very bad in others. We have already mentioned the case of South Korea without any assurance of what it proves, or which category it fits.

Some of the new Congressional interest may reflect primarily domestic concerns, in light of the revelations cited earlier of sloppy assurances against loss and theft within the U.S. itself. The concern may pass away again as some of the more faddish issues come and go, but the concern may instead become more deep-seated, with important implications for foreign countries' policies as well.

It is also possible, of course, that the new Congressional interventions reflect some substantial deepening of American public concerns about nuclear proliferation, in the aftermath of the Indian detonation. Despite the American sponsorship of the NPT in 1967 and 1968, there was reason to question whether fear of nuclear proliferation had very much affected much of the United States, or even much of the American government beyond the Arms Control and Disarmament Agency. Few could have argued that the Nixon Administration's reelection chances were being endangered by the Republicans' seeming indifference to the proliferation problem. It is a little too early to measure whether there has been a major change in American attitudes after the Indian "PNE," but such a change may indeed be occurring.. It is also too early to tell whether a more vehement American resistance to proliferation will help or hurt the arms control cause. As with everything else, the answer may vary from case to case.

TECHNOLOGICAL NEWS

Turning away from political developments again, have there been any changes in the technological outlook in the past two or three years to reverse or revise our expectations on nuclear proliferation? As noted, the increased price of oil surely has made nuclear power plants more economically attractive, while at the same time giving countries like Iran and Kuwait enormous sums of money which can be used to buy such power plants if the decision is made.

Yet if these factors accelerate the spread of reactors and plutonium, some other kinds of news suggest that it will all happen a little more slowly than predicted, not eliminating our proliferation problem indefinitely into the future, but at least giving us a little more time to get our house in order.

To begin, a great number of reactor installations, particularly in places like Iran, will have to be "turnkey" projects, wherein virtually everything is built and installed and initially operated by foreign technicians. The presence of so many foreigners may thus serve as an additional deterrent or brake to clandestine bomb projects. Beyond this, the dependence on external talent almost certainly will mean that the projects are not finished on schedule. Indeed, one might almost mint a general rule here that "no reactor ever begins producing electricity as originally scheduled." Perhaps this is because foreign bidders are guilty of the same excessive optimism on time schedules (in order to win bids) as American aircraft producers on cost estimates. The C-5A will fly all right, but at much more than the original cost. The French reactors will get put into Iran all right, but considerably later than predicted, and perhaps also with cost overruns. The inflation triggered by the OPEC oil revenues may also sap some of the purchasing power out of such revenues; contractors for nuclear reactors may plaintively have to try to renegotiate their delivery contracts with the Shah.

One immediate consideration slowing down installation and driving up costs is that of safety. As charges and rumors spread that many reactors are not as safe as they should be, some of such considerations will even hold back the threshold nuclear states which until now have not been so clearly ecology-minded or safety-minded. When reactor installations are delayed in the United States and Britain and Sweden, some of the concern will certainly reach Japan and may even reach the Middle East. The ease of selling reactors cheaply moreover depends to some extent on economics of scale; one can deliver more cheaply and easily to Brazil or Argentina as one has larger orders to fill in other countries. The cancellation or revision of reactor contracts at home may thus again slow down fulfillment of contracts abroad.

Having sketched out that much "good news" on the anti-proliferation scale (but "bad news" on the energy-provision scale), one should quickly note that safety considerations can also make proliferation easier, for the ins and outs of technology are continually perverse. There is some evidence now that natural-uranium reactors, such as those produced in Canada, may be less accident-prone than the enriched-uranium models upon which the United States has concentrated. Previously it had been generally concluded that the enriched-uranium reactors were more profitable. Sweden and Germany, and Brazil and Iran have indeed concentrated on this type because it seemed cost-effective. Enriched-uranium reactors furthermore are more conducive to arms control, because they have generated a dependence on the United States for enrichment services, and because the complicated and delicate designs of such reactors made it more difficult to extract the plutonium without a complete shutdown.

If safety must now be taken into account, however, it becomes part of the cost-effectiveness calculation also, and "what is best for the power companies" may again become "what is best for the national military potential." Neither form of reactor was ever proliferation-proof, of course, and other nations will soon enough be able to offer uranium enrichment services to compete with those of the United States, thus eliminating a powerful political lever. Yet the enriched-uranium reactor by-and-large has seemed less easy as a route to plutonium bombs. When India and Argentina earlier invested in natural-uranium reactors, this was seen as going against cost-effectiveness, to insure "independence", i.e. a weapons option. If safety reverses the calculation of cost-effectiveness now, we will thus have less clear symptoms on national intentions.

It is too early to tell how these calculations will work out in the end. The nuclear reactor business is plagued with all kinds of technological uncertainties, and some nations still seem to be betting on enriched-uranium reactors as the most profit-producing, even when ecology or safety are taken into account. Even the estimates of accident hazards find no real consensus among those scientists who should best know the facts, and one almost suspects that estimates are being developed as much for political impact as for scientific precision. In summary one might simply venture two more general predictions on proliferation impact. If reactor installations are slowed by safety and other considerations, this gives us more time to try to devise methods to prevent bomb projects. If nations switch to natural-uranium as a result of adding safety considerations to their deliberations, this gives us less time.

One last technological trend is altogether more helpful if it persists. Many of our "worst fears" on proliferation depend on the reasonable assumption that the plutonium produced by all the many power reactors of 1985 will be seen as a profitable fuel source for further use in new reactors, a fuel which must be reprocessed for such use. Sadly and unfortunately, when so reprocessed, it is virtually a weapons-grade fissionable material, quite readily convertible into atomic bombs.

Yet most recently there has been evidence that the reprocessing of such plutonium on a large scale may be considerably more complicated and expensive than originally predicted; if this held true under continued examination, plutonium might not be seen anymore as a valuable fuel urgently in need of reprocessing, but rather as an unusable garbage.

Such a development would hardly affect the nation deliberately intent on making bombs, for the plutonium could indeed be reprocessed at bearable costs where one is in the realm of military budget scales. But it would at least mean that nations were not quite "innocently and cost-effectively" accumulating large amounts of bomb-usable material. We would still have to try to keep track of all the world's plutonium, and would still have to worry about the establishment of smaller plutonium-reprocessing facilities quite clearly aimed at military projects. But it would be easier for the IAEA and the world to separate out civilian intent from military intent. Where civilian intent applied, if the above technological prediction held true, the countries involved would be eager to sell their plutonium back to any bidder, just to be rid of the stuff. Those eager to hang on to their plutonium would ipso facto be more suspect of having military intentions.

Again, technology here has its ins and outs, and the nuclear industry in five years might be announcing that it has solved all the problems of large-scale, low-cost, non-accident-prone plutonium reprocessing. This would indeed be good news for those worried about energy availability, and might be bad for those worried about proliferation. For the moment, some of the predictions go in the opposite direction.

One might be misidentifying the crux of our pessimism, however, if we focused too much on the large throughputs of plutonium for big power reactors. In many ways, the big power reactors will be a very costly way of producing plutonium bombs, since efficient production of weapons-grade plutonium will clearly conflict with efficient production of electricity, a conflict which might even be noticeable enough to help with the inspection problem. When a 1000 megawatt reactor consistently produces less than its rated output, there will be grounds for suspicion that plutonium is being removed from its core at early stages; there might also be grounds for grumbling among disappointed electricity consumers.

Bomb production may be much easier in the smaller "research reactors" which also are still spreading, of the scale of the Israeli reactor at Dimona or the Indian Candu reactor at Trombay. Much depends, of course, on the size of nuclear stockpile the erstwhile "nth" country is after. But the cost per bomb will be less in the smaller reactors (especially since there is no "opportunity cost" of electricity being given up).

Turning to a clearer round of "good news," much anxiety has been laid to rest about the costs that IAEA safeguards will impose on the peaceful nuclear industries being inspected. Seven years ago this was a major issue between supporters and opponents of the NPT, with fears continuously expressed that any effective safeguards would inherently prove so obtrusive as to threaten profits. The NPT five-year Review Conference was forecast as the point at which grievances on this question would be brought to a boil.

In the interval, however, technological ingenuity has uncovered a great range of satisfactory solutions to this problem, satisfactory in that the IAEA can expect to be effective, while inspected nations have reasons to feel assured that the cost will be acceptable. A sign of this has come already with the decision of Japanese industrial groups to support rather than oppose ratification of the NPT. A clearer sign has come with the conduct of the NPT Review Conference in May of 1975, which turned into an altogether tame event, with virtually total satisfaction being expressed on the safeguards question.

WHAT TRENDS IN THE NET?

With all of this back-and-forth on optimistic and pessimistic tendencies, is there any ground at all for optimism that proliferation can be stopped or contained? Won't the weakest link sooner or later snap the chain, with devastating results for mankind thereafter? Or shouldn't we decide now to spend all our time studying how to live with proliferation, rather than vainly expending any effort in trying to halt it?

When one combines political strands and technological and economic strands, one may not need to settle into so pessimistic a line. The most optimistic view would be that the world is asymptotically approaching the end of nuclear proliferation, for example, noting that the first decade of the nuclear age (1945-1955) produced three weapons arsenals in the U.S., the USSR and Britain, the next (1955-1965) produced two, France and China, while (1965-1975) has given us just one, India. This might be a very meaningless statistical array (will 1975-1985 give us zero new entries into the nuclear club, and then 1985-1995 give us minus one, as Britain gives up its membership?). Yet some sort of moderation is evident in whatever once seemed as a natural drive toward weapons as "every nation's birthright." Swedes lost their interest in nuclear weapons more than ten years ago, and Germans are losing it now. The best part of the news in the aftermath of the Indian explosion is that it engendered so little visible popular response around the world ("If they can be allowed to do it, why cannot we?").

If the goal of stopping the nuclear club at six is seen as unmanageable ("Isn't it already seven, after all, with Israel?"), this author would hardly see it as pointless to aim quietly at a goal of no more than ten by the year 2020. Much of what will be difficult or impossible or unbearable in international politics when one has twenty nuclear powers will be much less so as the club remains smaller.

The science of physics is to blame for the entire problem, but might yet come to our grandchildren's rescue. We have already brushed past the possibility that nature might be so kind as to make plutonium reprocessing too costly to be profitable. Hope is not yet to be abandoned that pure fusion processes may by the year 2020 have proved themselves the best way to produce electricity, processes which in no way require or justify the accumulation of bomb materials around the world. If that proved to be so, one could envisage then writing, and winning general acceptance for, a very different kind of non-proliferation treaty, one not merely banning bombs, but banning the possession of any "weapons-grade" materials whatsoever, however unshaped into bombs they might yet be.

The list of factors presented quite rightly suggests that this author is not prepared to bet on any single systemic solution to the proliferation risk. Countries vary too much, the containment of proliferation must drag on for too long a time, technology in its quirks is too unpredictable. Yet a pragmatic patchwork-quilt of barriers to further proliferation is not to be dismissed merely because it can not be summed up in a single sentence. The most essential ingredient in the prevention of proliferation may above all be patience, a patience which hardly is to be lost because India has been lost to the non-nuclear world.

A quite different issue buried in all our public discussions of the proliferation problem is the risk of the self-confirming proposition, in either direction. How well advised are we to announce our fears or suspicions that an Iranian or South Korean reactor program is actually primarily a bomb program in disguise? Pessimism is popular and a good pose for political-scientist predictors. If you are right, you are congratulated; if you're wrong, no one minds. But, isn't there a risk that writing a book to predict that Japan will want to acquire nuclear weapons can as a result persuade Japanese that this is indeed their inevitable destiny? Can't one make the case that our predictions should be more muted here, or indeed deliberately reversed? If we all predict that nuclear proliferation will stop, maybe this will help it stop.

Yet there is an opposite danger, too. If we guard against self-confirming pessimism, we might invest too much in the hope that optimism in the end will be self-confirming. One would thus hate to be caught saying that he sees "the light at the end of the tunnel" on nuclear proliferation, to be caught in the position of refusing to consider bad possibilities, for fear of making them more likely by the simple process of facing up to them.

What else can one say? Some sort of balance needs to be struck here. The temptations of "instant Cassandra" positions on nuclear proliferation should be avoided but the inherent risks of further proliferation should not be denied. What also should not be denied, however, is that there may be more Canadas and Swedens in the world in the future, nations fully capable of making atomic bombs, and bound and determined not to do so.

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